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A PROTOTYPE INFORMATION RETRIEVAL SYSTEM

FOR HEALTH, PHYSICAL EDUCATION

AND RECREATION

by



HOWARD NORMAN WATTS

A THESIS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "A Prototype Information Retrieval System for Health, Physical Education and Recreation", submitted by HOWARD NORMAN WATTS in partial fulfillment of the requirements for the degree of Master of Science.

ABSTRACT

The purpose of this study was to design and test a prototype information retrieval system for health, physical education and recreation capable of retrieving desired references to documents useful in the field, thereby making such information readily available to users. The references were retrieved using descriptor and author terms, or combinations of these.

The system was also designed so that information could be added and updated at regular intervals. It was designed to be adapted to the on-line system installed at the University of Alberta Computing Center, and a mechanized medium for recording user feedback and document relevance was also included in the system design.

The updating and expansion of a thesaurus for health, physical education and recreation was also a significant part of this study. A manual indexing procedure was used to describe the information content of the document, and to prepare the bibliographical material for input.

The data base was limited to 300 documents, which were theses and dissertations written in the last 25 years and stored in the physical education library at the University of Alberta.

The evaluation of the system by a group of twenty users provided the data necessary to conclude that the system, AIRHPER, can be employed by physical educators to retrieve bibliographical information on a wide variety of topics in the field.

The construction of the files, the machine search response time, and the source language employed, Fortran IV G, make it possible to adapt this system to the on-line facilities at the University of Alberta.

A mechanized medium for recording user feedback and document relevance was made possible by way of outputting a tally card in the search phase, and utilizing this card to tally the frequency of document retrieval and user need.

The resulting thesaurus for health, physical education and recreation proved to be useful in the indexing and retrieval of information in the field. The manual system of indexing was effective in describing the information contained in the documents. The use of more explanations for descriptors, or scope notes, in the thesaurus should improve the manual indexing procedure.

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CHAPTER I

STATEMENT OF THE PROBLEM

The question is not whether men need information, for they do. Rather, the issue is whether the information available to them is of the right kind and quantity, of acceptable accuracy, and of appropriate timeliness.

Nehnevajsa

Introduction

Physical education is a rapidly growing field of knowledge, and as in many other subject fields, there is the problem of efficiently storing and disseminating information. The great wealth of information potentially available to the physical educator in many areas of the field stands a high chance of suffering serious losses if information retrieval systems are not developed to properly store the information, and, more important, make it readily available to the physical educator.

The physical educator must rely on the field of knowledge if he is to implement a curriculum and educate people. This simply states what physical educators have realized for many years; in fact the national executive of the Canadian Association for Health, Physical Education and Recreation included this principle in the first constitution of this association and the second aim is written as follows:

Relating to health and physical education the aims of the association shall be:

. . . to acquire and disseminate knowledge concerning it.

Effective communication links are prime concerns if the professional organization is to realize this constitutional aim. An information retrieval system designed to meet the specific needs of the professional physical educator can contribute to a solution of the communication problem in the field of physical education.

Hemphill (16) and Austin (1) refer to the lag between current knowledge and that which goes to the development of curriculum in education. This information lag is extremely great in their estimation and a major concern if education is to have quality in its program. Borko (5) notes that there exist a number of institutions and related media for the transmission of information. Although these continue to serve useful functions they are inadequate to meet the communication needs of today's society. Borko lists some of the factors contributing to their inadequacies: (1) the growth in science and technology and the rate at which new knowledge becomes available and old knowledge becomes obsolete; (2) the great number of working scientists and the large number of publications; (3) the increased specialization which makes communication and exchange of information between disciplines very difficult; (4) the short time lag between research and application making the need for information more pressing.

Although manual indices remain useful tools for searching, exhaustive searching procedures along varying dimensions may be handled more effectively by the computer and a coordinate index system.

The Problem

The purpose of this study is to design and test a prototype information retrieval system for health, physical education and recreation

which is capable of retrieving desired references to documents useful in the field, and making such information available to individuals in the subject field.

Sub-problems

1. To design a system capable of retrieving bibliographical information utilizing descriptor terms and authors, or combinations of these.
2. To design a system which is capable of being up-dated at regular intervals.
3. To design a system capable of adaption to on-line system (IBM 360/67) installed at the University of Alberta computing center.
4. To design a system providing a mechanized medium by which continuous feedback from users is recorded.
5. To up-date the current thesaurus for health, physical education, and recreation.

Delimitations

The prototype system deals entirely with unpublished theses and doctoral dissertations on microcard or hardcopy. All documents are currently on file in the physical education library at the University of Alberta. The size of the test system is 300 documents.

Definition and Explanation of Terms

AIRHPER: The system is called Alberta Information Retrieval for Health, Physical Education and Recreation.

Caretaker Files: The data files consisting of the location of each record in the inverted file, the number of entries in each current record, and

the space available in each record of the inverted file. This information is necessary to the maintenance of the inverted file.

Citation File: The sequential file of bibliographical records which is stored on tape or disc; records from this main file are printed as hits at search time.

Document: An instrument having recorded information capable of being handled and read, i.e. microcard or hard copy.

Document Number: The first five characters of the document reference code. Each document is assigned a number in sequence.

Document Reference Code: The code of 15 alphameric characters which uniquely identifies the document.

Hit: A bibliographical reference printed at search time.

Indexing: The act of preparing an organized list which specifies or indicates the information, contents, or topics in a document.

Information Retrieval System: The system employing an electronic computer which is instructed to inform the user on the existence (or non-existence) and whereabouts of documents relating to his request. The system ultimately provides the user with full document texts.

Input Profile: The machine card sequence which contains the bibliographical information and the tagged descriptor terms to be input to the system files.

Inverted File: The file containing the document numbers linked to each of the term code numbers which have been employed as tags for documents in

the current citation file.

Natural Language Concepts: The natural language terms taken from the text of the document, and used at indexing time to describe the information content of the document.

Precision Ratio: The ratio of the number of relevant documents retrieved to the total number of documents retrieved.

Program LIBRARY: The computer program, written in the source language FORTRAN IV G, which prints the contents of the citation file stored on magnetic tape.

Program FILE: The computer program, written in the source language FORTRAN IV G, which inputs the system thesaurus, the caretaker files, and the input profiles. The computer procedure creates the inverted and citation files, or adds data to the existing files.

Program PRE-FILE: The computer program, written in the source language FORTRAN IV G, which inputs the system thesaurus, and the input profiles. The computer procedure checks all terms used in the descriptor records, and prints out the full citation to be filed, so that it can be verified at the termination of this computer job.

Program SEARCH: The computer program, written in the source language FORTRAN IV G, which inputs the system thesaurus, the caretaker files, the search profiles, and the date of search. The computer procedure searches the inverted and citation files to establish the hits which satisfy the question, and prints the appropriate references from the citation file.

Program TALLY: The computer program, written in the source language FORTRAN IV G, which inputs the document numbers found, the current totals, and tallies the number of times each document number is input.

Question: A request to retrieve information which may be stored in the system file. A form is available to structure such a request so that a search profile may be formulated.

Recall Ratio: The ratio of the number of relevant documents retrieved to the total relevant collection in the file.

Searching: The process of examining a series of items until one, or more, with the desired properties is found.

Search Parameter: The part of the search profile which is initiated by the parameter operators AND or NOT, and it consists of one or more terms.

Search Profile: The machine card arrangement of descriptor and/or author terms, separated by Boolean operators, which is the question input data in the program SEARCH.

Term Code Number: The number assigned to each authorized descriptor term in the thesaurus.

Terms: Two types of terms are employed in the system. The descriptor terms are those authorized terms which appear in the system thesaurus. Author terms refer to those author surnames, and initials, which may also be used in formulating a search.

Thesaurus: An authority list of approved descriptor terms where words are grouped by concepts or ideas, and synonyms are controlled by references.

CHAPTER II

REVIEW OF THE LITERATURE

Information retrieval as a term has come into fashion during the last decade, yet for many more years there have existed ways of retrieving information. There exists at present numerous means of discovering and rediscovering information and these vary from the reading of the daily newspaper to the use of a highly specialized indexing system. Vickery (34) indicated that today information retrieval is an aspect of a wider field known as human communication; Cherry (10) made reference to information retrieval in a discussion of communications engineering.

Lancaster (21) clarified the distinctions evident in information retrieval systems which are designed for specific objectives. An information system may retrieve complete document texts, document surrogates, or full bibliographical citations. A system that ultimately provides the user with the complete text of the document is properly known as a document retrieval system. A system that presents only citations is a reference retrieval system. An information retrieval system usually operates in a number of stages, and although reference citations may be the initial form of output, through a subsequent request to the system the user may retrieve the full document text. In using the term information retrieval system, the current meaning is primarily a system capable of retrieving documents in answer to particular subject requests.

Lipetz (23) described a very real limitation in the design of

information retrieval systems. He illustrated the problems of indexing one record, a photographic slide, by describing the dimension of the potential attributes of this document. Any one of these attributes, date of photograph, location of picture, individuals in picture, type of camera used, objects in the background, and many others, could serve as the basis for a question to the system. Lipetz concluded that not only is it impossible to create an information storage and retrieval system that will respond fully to all possible questions, but also it would be prohibitively expensive to try to approach such a condition. In actual practice all information systems must adopt more modest objectives. Lipetz continued by stating that all systems are founded with some degree of knowledge of what kind of records are available and what general type of questions interest the potential users.

Physical Education Storage and Retrieval

The Canadian Department of National Health and Welfare (13) currently maintains the Canadian Documentation Centre in Ottawa. This centre is responsible for the storage of selected documents in the areas health, physical education and recreation. Though entirely a manual system, its function includes the retrieval of information in response to requests of Canadians interested in the type of material stored at the Centre. The general contents of the centre may be briefly summarized:

a) Historical materials pertaining to the federal program and most provincial programs are stored at the Centre. The information material dates back to 1943, with the passing of the National Physical Fitness Act.

b) Approximately 300 subscriptions to professional journals and

periodicals are catalogued in the centre.

c) The Centre is attempting to gain a copy of each thesis written by a graduate student who has received a Fitness and Amateur Sport Scholarship. There is also a somewhat incomplete list of theses written by Canadians who have taken post-graduate work in physical education and recreation.

d) A reference section of texts, sports dictionaries, Index Medicus, and other indices are kept on file and these are used daily in searching for bibliographical information to answer queries put to the Centre.

The Educational Materials Consultant for Fitness and Amateur Sport estimated the average monthly requests to the Centre at 60 to 75. All searching procedures are handled manually, and most documents are made available on the interlibrary loan system. The Consultant has indicated that the system is not capable of handling large volumes of requests.

Olsen (27) reports that in 1959, a first international conference on the problems of documentation and information in physical education and sport was organized in Graz, Austria, by Recla. Upon the establishment of the International Council of Sport and Physical Education (ICSPE) in Rome in 1960, Recla and others prepared to form the Documentation and Information Bureau of ICSPE. One of the first major tasks of the Bureau was to solve the problem of classification, and a special classification committee was formed.

The United States Office of Education (15) through its bureau of research has established a clearinghouse for documents on higher education at George Washington University. The Higher Education Clearinghouse is part

of the Education Resources Information Centre (ERIC), a network of clearinghouses that collect and disseminate educational research, documents, articles, and bibliographical resources. Although physical education information materials are part of this system, it has been designed to handle education documents generally, and therefore little use is specifically physical education. Subject specialists at the clearinghouses screen the documents for quality and usefulness. Those selected are summarized, then indexed using ERIC's thesaurus terms, and finally copied on microfiche. The microfiche is stored at ERIC Central, and upon request, they are retrieved and reproduced on either hard copy or microfiche. ERIC Central also publishes indices and announcements of new acquisitions. Presently, ERIC is partially automated and will eventually produce computer tapes containing the full record of all current documents for those who want to develop search and retrieval capabilities.

On-Line Retrieval

Licklider (22) stated that future information storage and retrieval systems will rely heavily on the concept of time-sharing. Future systems will require immediate response and direct communication with the stored information. A user, through immediate feedback, will be able to restructure the search formulation in order to narrow the information response. Computer time-sharing has become more generally available; many more interactive systems are being designed (4). Four real-time information retrieval systems are briefly described below.

The BOLD System

Borko and Burnaugh (6) described the BOLD (Bibliographic On-Line Display) document retrieval system. This is a real-time on-line experimental

system which is designed for research as well as information storage and retrieval. The system utilizes teletypewriters and cathode ray tubes (CRT) as terminal devices. The time required to output information using the CRT is extremely short, and such information on the CRT can be transferred to teletypewriters or magnetic tape for off-line storage.

Every document entered in the BOLD system must be manually indexed, and in order to transform a natural language request into the language utilized by the data base in the BOLD system, a dictionary of authorized terms is constructed. The basic entry in the dictionary is the descriptor, under which entries are defined. The dictionary consists of a hierarchical structure that represents a classification of every term in the data base. The user has a high degree of control over this dictionary and he can add, delete and replace terms to suit his own needs.

In order to retrieve documents, a man-machine dialogue is initiated. The system begins by listing all categories of the data base on the CRT. Using a light pen, the user selects a category to which the system responds by flashing all sub-categories. The user continues to work his way through the classification tree until retrieval terms which can be used in a search request are presented. He then selects one of the modes, search or browse. In the search mode, a request is formulated by use of terms along with Boolean operators. All document identifiers satisfying the request, ranked by the number of retrieval terms it contains, is returned. The user may then delete any document and the next document may be requested at any time to determine if the article is relevant. In the browse mode any descriptor may be used. The browse may be limited to specific categories, or may range over the entire data base. The user can browse through documents retrieved

by this method and also examine abstracts of interest.

The design of the BOLD system permits the use of dictionaries specifically adapted for a given user. It is therefore possible for a user to design his own basis of communication through an individual vocabulary and classification scheme.

The CONVERSE System

Drew et al. (14) described the CONVERSE system which is operational at Lockheed Missile and Space Company. The system is designed about a time-shared computer with a remote card reader input device and teletypewriter output unit.

The system selects the group of descriptors best describing the documents desired. A file of punch cards containing all descriptors in the system stands beside the input terminal. There is also a card reader capable of reading, at one time, a single manually entered card. The desired descriptor cards are selected from this file and arranged, along with the control cards, in a deck to be read by the terminal card reader. After reading all of the selected cards, the system outputs on a teletypewriter the documents that satisfy the request. If three or less documents are found, all the bibliographical information is printed. If four to fifteen are found, the document reference numbers are output. If more than fifteen are found, a count of the number of documents is output. The user in the last instance would restructure his search question and input the request again.

Two magnetic files are used for search and retrieval. The first tape file consists of all information appearing as output. The second file is an inverted file whereby each descriptor is followed by a list of

documents using that descriptor. It is the inverted file which is searched in response to requests.

The system was one of the first operational information retrieval systems employing the real-time, time-shared approach.

The TIP Project

The Technical Information Project (TIP) at Massachusetts Institute of Technology was designed and described by Kessler (18) and Salton (31). This information retrieval system is operational on a real-time, time-shared system with remote teletypewriters for input and output.

The technical literature searched is within journal articles related to physics. The journal title, volume number, page number, article title, and author(s), plus other relevant bibliographical information is key punched onto cards. This input data is edited and placed on disc storage for access by the computer. No abstracting, reviewing, or editing of the source material is done. Title words and bibliographical data are relied upon for retrieval of the article references. Although no costly data preparation is necessary, useful information may be lost in this type of searching procedure.

The retrieval system consists of three parts. The SEARCH command specifies the range of journals to be searched, i.e. recent issues, a certain year, or all journals. The FIND command indicates what elements are to be searched, i.e., author, words in the title, or source of the document. The third command, OUTPUT, specified the type of output, i.e. store, print, or count the references.

Since articles do not have index terms, there are only two ways of retrieving relevant material. Words in the title may be specified, or articles may be located which share a common element such as author or citation. If two documents cite a common reference, it is assumed that they deal with related topics. This type of sharing is termed bibliographic coupling and in a narrow technical field this is a reasonable method of linking documents. The user of the TIP system can make a preliminary search for a title word to limit the amount of material scanned. By then requesting articles that share citations, a good amount of the material in a narrow sub-field can be found.

The SMART System

At Cornell University, Salton (30) has developed the computer - based SMART information retrieval system. SMART is designed to take full advantage of user interaction with the system. The user may specify a search request, analyze the output, and repeatedly respecify the request or search made until the users' needs are fulfilled. This system is an experimental project and much effort has been devoted to the testing of a large variety of automatic retrieval procedures. In the SMART system, both documents and search requests are processed, without manual analysis, by one of a number of automatic content analysis methods. After determining which analysis procedures one desired, the user formulates a search request in full English sentences, with no prior coding. The request, along with the full text of all documents in the collection, is analyzed according to the specified analysis procedures. The request is correlated with the documents in storage, and the highly correlated documents are output in the print-out phase.

The entire text of each document is input to the system with no prior editing or indexing. Since no processing is done on the input data, the analysis procedures are the core of the SMART system. The request for a document can be regarded as another document to be analyzed by the same procedures used to analyze the text of all the documents in storage. It is these documents which correlated highly with the request vector that is returned as satisfying the request. The request vector may have its terms weighted by the user, in addition to being expanded by the analysis procedures. Hence, the user may retain control over terms used in the search. The user can vary four variables which affect the search by: (1) specifying the correlation measures used, (2) changing the correlation threshold value, (3) varying the analysis procedures, (4) restructuring the search request.

Salton (29) has summarized the system characteristics of on-line, time-sharing information retrieval systems. He has indicated that the advent of such computer organization has made possible automatic information handling systems that combine many of the services provided by standard library and documentation centres while permitting the user to take part in the search and retrieval process.

Such systems can store documents and data descriptions as well as user characteristics identifying customer interests and needs; they provide facilities for performing automatic content analysis and indexing procedures, document abstracting services, information search and comparison operations, selective information dissemination, and document distribution.

A most prominent characteristic of the time-sharing systems is the user participation in the system by furnishing information about his needs and interests, and thereby directing the search and retrieval operations in accordance with the user's special requirements. The media that permits the user to communicate with the document or data handling system may consist of a variety of input-output terminals, often located at great distances from the location of the control system. One system may accommodate many terminals, serving simultaneously many different users.

Document Description and Indexing

Baxendale (3) stated that the index to a document collection is the prime and central component in any information retrieval system. The ultimate effectiveness of the entire system depends upon the adequacy of the indexing language, and the consistency of its use.

Lancaster (21) described two distinct types of failure due to the indexing subsystem: (1) those due to indexer errors, and (2) those due to a policy decision regarding the average number of terms assigned in indexing. The indexer errors may include omission of a term or terms necessary to describe an important topic discussed in an article, and the use of a term that appears inappropriate to the subject matter of the article. Omissions will normally lead to recall failures, while use of an inappropriate term can cause either precision failure or a recall failure. The indexing policy decision influences the exhaustivity of the indexing. An item of the subject matter treated peripherally in an article is not covered in the indexing. This topic is regarded as not crucial to the article, and is excluded in favour of other topics due to a general policy regarding the average number of terms to be assigned.

Vickery (34) has explained the problems which exist in deciding the contents of a document and manually or mechanically classifying or indexing the material. In the same section Vickery has explained the attempts to statistically ascertain the probability of retrieving a single document knowing the number of terms in the system as well as the number of terms used to index a document. If each document were used equally often to represent a document, then each would be used F times: $F = AC/B$, where A = number of documents in the system, B = number of descriptors in the system, and C = the number of descriptors per document. This formula produces highly theoretically figures as the underlying assumption in this statistic is that each descriptor is used equally often. This does not hold in the operation of an actual system.

In his text, Salton (29) noted that it is usually necessary to replace the original words used in a document by standardized entities. A set of subject experts choose the appropriate terms and relations using lists of permissible terms, including hierarchical arrangements, and thesauri specifying various kinds of cross references between terms. The artificiality of attempting to restrict the content of documents is a problem, as no simplified language is likely to prove generally acceptable. In certain circumstances it is necessary to deal with the natural languages and with a variety of relations between them.

Williams (36) has outlined a procedure for assessing the contents of a document, and then indexing the same for input to the information storage and retrieval system. The use of two indexers was advocated to reduce the errors made by indexers. The second indexer checked the work of the first and made additions or deletions in the index terms that were

deemed necessary.

Sharp (32) cited the research indicating that the hardware capabilities for information systems are undoubtedly available, but that the problems generated in the software of documentation. Some authors have expressed confidence in the success of automatic text analysis.

The effectiveness of automatic indexing in terms of the Cranfield Project was explained by Salton (29). The manual indexing process has proven to be highly desirable in this project, although it is not possible to say that the automatic indexing process is substantially inferior to the manual indexing method. The automatic word-word association method appeared to be more profitable in the case of larger or less homogeneous collections. In this situation the manual indexing tends to be less effective because of the variabilities among the indexers and the difficulties of ensuring a uniform application of a given set of indexing rules to all documents.

Further, Salton (29), has noted that the stem title only procedure is effectively equivalent to the KWIC index, and this process that takes into account only the words from document titles is not nearly as effective as an equally simple process that matches word stems from the full text or abstract.

An emergent feature of Sharp's(32) review of the literature concerning index languages and indexing procedure was that attempts at over-sophistication are not worthwhile for many retrieval systems. He cited Cleverdon and Keen's finding in the Cranfield Project, that the single term index languages are superior to any other type. Salton (29) stated that the conclusions reached by the Cranfield Project were substantiated by the SMART studies, that being phrase languages are not substantially superior

to single terms as indexing devices.

The view expressed by Baxendale (3) was that computer-aided indexing and interrogation remains quantitatively and economically superior to fully automatic methods. A significant technical breakthrough is necessary to provide satisfactory methods of full-text processing for content analysis and description. It therefore remains necessary to rely upon the manually produced description of the document information.

File Organization and Searching Procedures

Vickery (34) stated that the organization of a file is not governed by the descriptor language, but it is merely a physical design problem. Tape oriented systems imply a sequential physical structure in which the data elements are usually scanned in sequence. Some designers provide an index that is searched first, followed by retrieval from the main file, which is sequenced on tape by citation number. Curtice (11) showed that for serial media, searching the main file is generally more efficient than searching the index. The index must be maintained, and maintenance operations become more complex using the inverted file. Curtice further noted that storing both the index and the main file on disc will lead to advantages not achieved for tape stored data. Bradhorst and Eckert (8) reported that in an actual system at the NASA Scientific and Technical Information Facility, the straight linear file search using tape is an improvement over the inverted index search followed by a linear file search. However, Minker and Sable (25) described projects where the inverted file approach is used successfully.

Salton (29) has stated that inverted files using the look-up method are normally much more efficient than the complete file search

process, since only a small portion of the file needs to be examined. The response time in this type of file may be short enough to provide tolerable service to individual users on real-time basis. However, the inverted system access is normally provided with respect to only a single type of key or descriptor, and the system may not therefore be adequate to express the retrieval specifications with enough accuracy to satisfy all users. Using the inverted file system, the number of required comparisons depends on the number of terms specified by the search request, and as the search terms increase in number, the larger the size of the file that must be examined. Salton continued the comparison of inverted and direct files by statistically analyzing the number of characters searched in the direct, inverted and the combined (inverted and direct) file systems. The sample cited involved the searching of 450 million characters in the direct file search of three million items, each of 150 characters. The inverted file system required a scan of just over 31 million characters, while it is necessary to only scan approximately five million characters using the combined file system.

Lancaster (21) illustrated how file organization has no bearing on the recall and precision performance of the system. However, it was indicated that the file organization and physical form of the index have a proven effect upon such factors as response time, effort of system-user and system-operator, form of search product, and system economics.

The Evaluation of Computer-Based Retrieval Systems

In discussing system evaluation it is necessary to distinguish between several different types of evaluation environments. Salton (29) indicated that the overriding criteria is the degree to which the system

satisfies the user population. He cited Cleverdon's six main user criteria which affect user satisfaction: coverage of the collection, time lag in search, form of presentation of the output, user effort, recall of the system, and the precision of the system. The evaluation is primarily concentrated on recall and precision, or the emphasis is placed upon the analysis and search techniques that are useful in retrieving wanted material, and in rejecting unwanted material. The recall ratio for a given search is defined as the proportion of the relevant documents in the collection that are actually retrieved. The precision ratio is the proportion of the total number of items retrieved that are actually relevant. It is further explained in the same section that recall and precision calculations are also affected by the cut-off point chosen to distinguish relevant from non-relevant documents. It may be necessary to define the ratios in terms of the ranks of the relevant documents.

One of the major problems in the evaluation of systems is that the recall value is a function of the relevant documents not retrieved as well as the relevant documents retrieved. In theory, it would be necessary to examine every document in the collection. Salton (29) suggested ways in which this can be operationally overcome. Sampling techniques may be used to generalize to the entire document collection. A second possible procedure is to approximate recall based upon search requests on certain known source documents in the collection. Larger systems may attempt a number of searches postulating that all relevant documents would be retrieved over many searches.

Baker and Nance (2) emphasized the necessity to consider environment within which systems operate. They considered an information storage and retrieval system (ISRS) as a subsystem within a larger system-complex which includes the users and the funders of the retrieval system. The

components are linked in a close-looped feedback system in which the user response influences both the funding and the operation of the ISRS as it attempts to satisfy user needs within a finite budget allocation.

King (19) cited other studies which emphasize the necessity of user interaction, and user satisfaction in system design. He also made reference to other research which points to a possible overemphasis on the role of the user, and a caution that too many compromises to accommodate the user may result in static systems.

Bourne (7) commented on experiments performed to date concerning the testing of storage and retrieval systems. He indicated that it is extremely difficult to make meaningful generalizations about the performance of various systems. The systems themselves differ widely in a number of factors, and the actual numerical values given for a particular indexing system would appear to have value for only that system. Hence results of system evaluation can only be interpreted in terms of the particular system under test.

CHAPTER III

METHODS AND PROCEDURES

Document Selection

Each document selected for input to the system was a masters' thesis or doctoral dissertation written in the past 25 years. An attempt to select a cross section of topics in the field of health, physical education and recreation was made. The broader terms listed in A Thesaurus for Health, Physical Education and Recreation (35) (see Appendix E), hereafter called the thesaurus, were used as a guide to the topics in the field. Some priority for selection was given documents written by Canadian authors.

Indexing

Documents were indexed for input to the system utilizing a coordinate method. The thesaurus was used as the authority list of descriptors, and only thesaurus terms could be employed to describe the information content of a document.

The exhaustivity of the indexing was governed by the generic levels already established in the thesaurus. Standardization of viewpoint and level of indexing was closely maintained by one individual performing all the indexing. A tendency toward a definite level of indexing prevailed when there was a similarity of information content.

The number of descriptor terms available in the thesaurus was 665, and the frequency of use for terms varied considerably. Although between 4

and 24 descriptors were used to index each document, the most frequent number of terms employed varied between 6 and 10.

The rules for indexing follow.

1. The indexer read the title, the abstract (if available), the table of contents, the purpose of the study or statement of the problem, all lists of appended material, and the summary.
2. The indexer attempted to describe the information content of the document by selecting natural language concepts from the document which presented potential conjunctions likely to be searched by the users. The indexer listed these terms in any order.
3. The publication year and the periods of time (dates) relevant to the information content of the document were noted by the indexer.
4. The thesaurus was referred to for authority descriptor terms which describe the information content of the document. The natural language concepts selected provided assistance in finding the thesaurus terms relevant, and the format of the thesaurus gave insight into further terms which may be used. In the use of all terms, two factors were fundamental. Terms were used only if they would produce relevant search results, and terms not employed merely to classify the information content. At this point in the indexing process decisions were made as to the appropriateness of adding a new thesaurus term to the authority word list. If the term was not redundant, and it was decided that the term would be most useful, it was added to the existing thesaurus.
5. The indexer skimmed the document again, and in this operation

added necessary terms which modified the terms already selected. An attempt was made to index generically as low as the thesaurus would permit. Broader terms were added where it was certain that they described the information content. The limit to the number of terms was 24.

6. The authorized indexing terms for the document were printed as descriptors on the indexing coding form. The details necessary to complete the indexing form are described in the next section.

The indexer was a professional physical educator, and hence very familiar with the terminology and the type of research performed in the field. This experience permitted the indexer to judge the dimensions by which documents would be relevant to the users of the system. The average indexing time was recorded and described in the system evaluation.

Key Punching and Input

The input profile of machine cards was prepared from the indexing coding form (Appendix B). The profile for each document included three records which were key punched onto between five and ten cards. Each card in the profile contained the document reference code which took the following form:

NNNNN-AAAAAAAAA

where N is a blank or a number 0 to 9

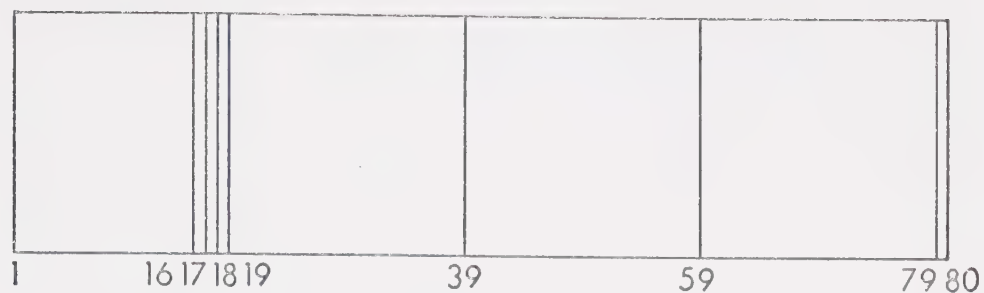
A is a letter of the author's surname,

followed by one blank and initials

if applicable.

The authors/title record consisted of three cards; the format for the cards is illustrated in Figure 1 and Figure 2.

Figure 1 The authors/title record (card 1).



columns 1 - 15 document reference code

16 authors/title record identifier (A)

17 record sequence number

18 number of authors

19 - 38 first author

39 - 58 second author^a

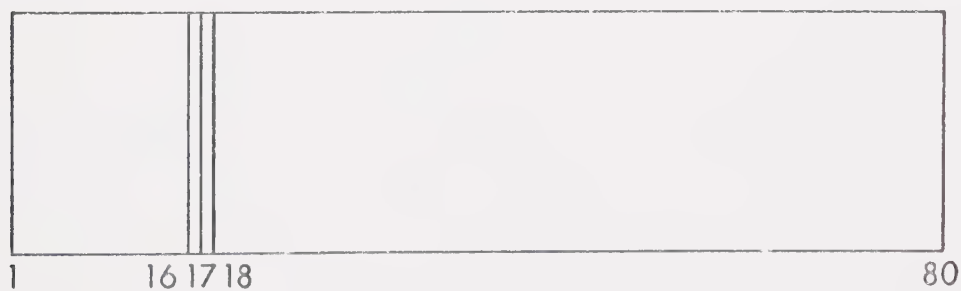
59 - 78 third author^b

79 - 80 title

^a39 - 80 title (if one author)

^b59 - 80 title (if two authors)

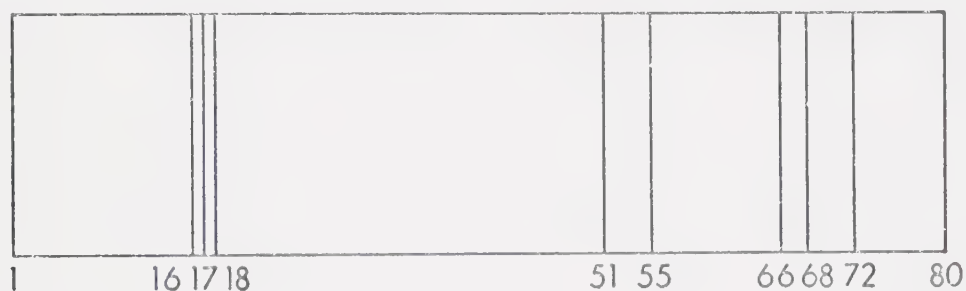
Figure 2 The authors/title record (cards 2 and 3).



columns 1 - 15 document reference code
 16 authors/title record identifier (A)
 17 record sequence number
 18 - 80 title, or blank

The source record consisted of 1 card; the format for the card is illustrated in Figure 3.

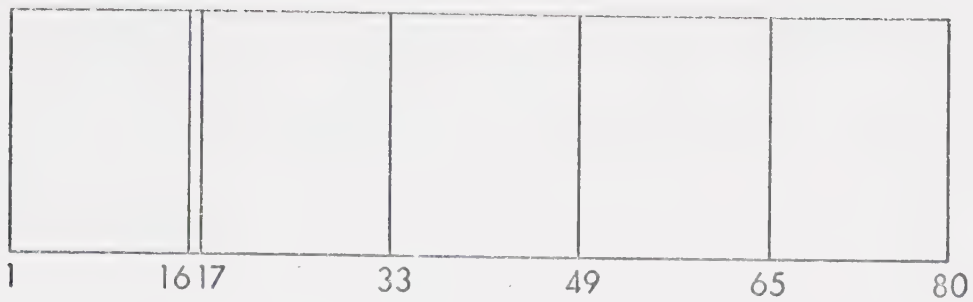
Figure 3 The source record.



columns 1 - 15 document reference code
 16 source record identifier (C)
 18 - 17 record sequence number
 18 - 50 university source
 51 - 54 year of completion/publication
 55 - 65 shelf number (L.C. Number)
 66 - 67 library location
 68 - 71 form microcard (MICR) or
 hard copy (COPY)

The descriptor record consisted of from 1 to 6 cards; the card format is shown in Figure 4.

Figure 4 The descriptor record.



columns 1 - 15 document reference code
 16 descriptor record identifier (D)
 17 - 32 first descriptor
 33 - 48 second descriptor
 49 - 64 third descriptor
 65 - 80 fourth descriptor

The last descriptor field must be a blank field unless the maximum 24 descriptor terms are entered.

A sample input profile appears in Appendix C, and this illustration gives the order and meaning to the description above.

File Organization

The document input profiles were read into the computer on machine cards and the bibliographic information was stored by document number in the direct access storage citation file. The descriptor terms, in the input profile, were read and verified with the system thesaurus and a term code number was looked up for each of the descriptors. The document number, linked to each of the term code numbers, was entered in the system inverted file. The inverted file contained a record on direct access storage for each term used to index the documents in the citation file. The position

of records in the inverted file, and the necessary data to maintain this file, was stored in the caretaker files. The computer program procedure FILE was designed to read the input profiles, create or add to the citation and inverted files, and update and output the caretaker files.

Updating Procedure

The computer program procedure FILE was used to recreate the system files following any changes or update to the current files. If new terms were added to the system thesaurus, the terms were added to the thesaurus card file in alphabetical order (see thesaurus Appendix E). The files were searched by the program SEARCH to output the documents already in the system which might be indexed with one or more of the new terms. The terms were added to the appropriate document input profiles. The files could be then recreated on a new tape, and used for subsequent searching.

Documents were deleted by removing the input profiles from the card files, adding new documents in their places if desired and recreating the new inverted and citation files by the program procedure FILE. The document numbers deleted were attached to new document entries to the system.

Format of the Question

The user of the system was required to structure the question to be input in the clearest possible manner. From this well defined question, the question coding form (Appendix B) and the system thesaurus could be employed to formulate the search parameters. This involvement of the user in the actual structure of the search was essential for any system which is

capable, or potentially capable, of real time interaction with the user.

The user had the opportunity of formulating term parameters which could be employed in searching descriptor records, or author records and descriptor records. The descriptor terms used had to be authorized descriptors in the system thesaurus. Author terms could be 20 characters in length, surname followed by one blank, first initial, period punctuation, second initial, period punctuation, and repeat for any number of initials. Any portion of the 20 character field could also be searched.

The user filled in the heading of the question on the question form, and completed his name and address. The search profile was initiated by the parameter operator AND descriptor terms followed the first operator as the design of the system demanded that the first parameter be a descriptor parameter. The following rules guided the formulation of the remainder of the search profile:

1. Each new parameter must begin with AND or NOT.
2. Descriptor parameters precede author parameters.
3. While using author terms, AND parameters precede NOT parameters, and only one AND and/or one NOT parameter is permitted.
4. A single parameter may not contain both author and descriptor terms.
5. The maximum number of parameters to a question is 10, and a maximum of 25 terms may be used in any one parameter.
6. The identifiers D or A must be included with any term in a parameter.

7. In order that the files may be searched, the profile must conclude with the command SEARCH.

To increase the probability of satisfying a parameter, it was necessary to examine the thesaurus for synonyms and near-synonyms which could complement the descriptor parameter. The greater the number of terms in any one parameter, the higher the probability of satisfying the given parameter.

In order to improve the precision of the response, the number of AND parameters, or NOT parameters, was increased. The output response to any question was altered by the number of parameters, and the number of terms within each parameter.

The question structure was conveyed to the machine through the logic variable. The values which the logic variable may have within a single question are as follows:

AND initiates a new parameter, and any one term listed under it will satisfy the parameter.

NOT initiates a logical NOT parameter; the terms listed under it must not be included in a hit.

The system output document references which satisfied all parameters listed in the search profile.

Key Punching and Searching

The search profile of machine cards was prepared from the Question Form. There were five types of cards permitted in the question, and these are presented below in the order appearing in the profile.

The heading card format is illustrated (Figure 5) and explained below.

Figure 5 The heading card.

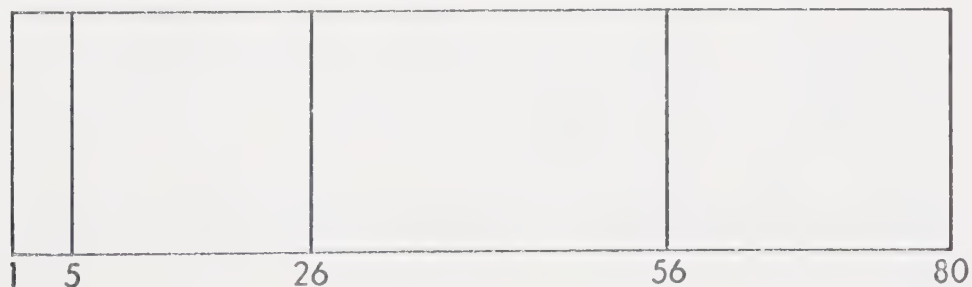


columns 1 - 5 the heading TITLE or AGAIN followed by
one blank.

6 - 80 appropriate title for the question -
or user comments as a heading for each
page of the final output for the question.

The address card format is illustrated (Figure 6) and explained below.

Figure 6 The address card.



columns 1 - 4 the word FOR followed by one blank.

5 - 25 users name

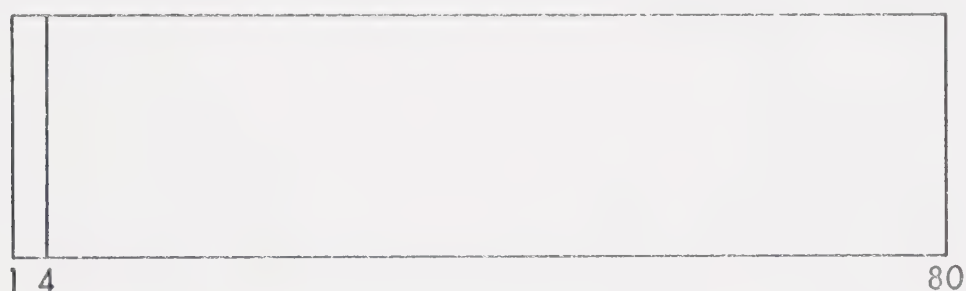
26 - 53 address, number and street or blank.

56 - 80 address, city and province or blank.

The address card was omitted if a single user had submitted more than one question. The heading card of the second and subsequent questions should begin with AGAIN, no address card follows, and the series of questions from this user was run consecutively.

The parameter card format is illustrated (Figure 7) and explained below. This card contained the logic variable.

Figure 7 The parameter card.

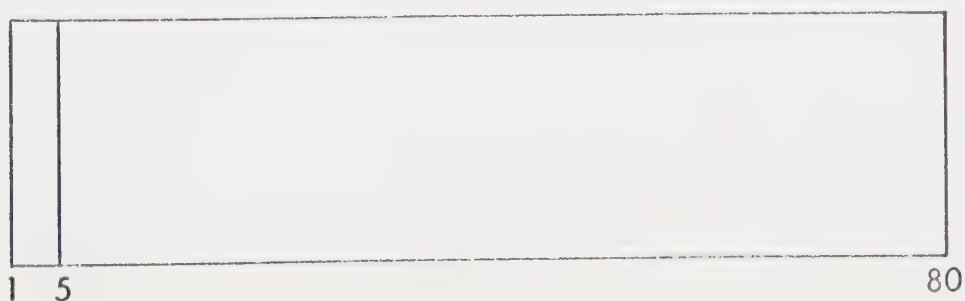


columns 1 - 3 the parameter words AND or NOT

4 - 80 blank

The term card format is illustrated (Figure 8) and explained below. This card contained the term identifier and the author or descriptor term.

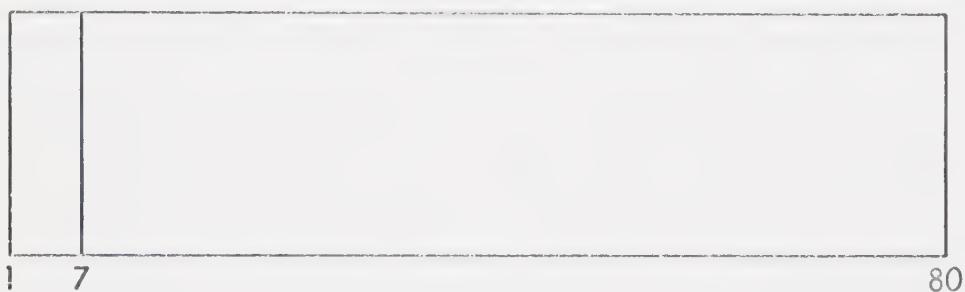
Figure 8 The term card.



columns 1 - 2 the term identifier (A or D) and one blank
 3 - 80 the descriptor term or author term (the
 first 16 characters of the descriptor term,
 and the first 20 of the author term are
 recognized).

The search card format is illustrated (Figure 9) and explained below.

Figure 9 The search card.



columns 1 - 6 the command SEARCH
 7 - 80 blank

An illustration of the search profile appears in Appendix C, and this illustration gives order and meaning to the description above.

File Search and Output

The search profile was read and the descriptor terms used in the question were verified with the system thesaurus. If any term used was in error, or there appeared a serious error in the profile, no search was performed and an appropriate message was output. If no errors occurred, the system inverted file was searched to retrieve the document numbers which satisfied the descriptor parameters in the question. If author

parameters were included, the procedure checked the author parameters by comparing the input author term(s) to the citation file records found by the descriptor parameters. Those citations satisfying all parameters of a question were printed. Each question was treated separately, and if errors prevented the response to the question, this did not interfere with the response to any other question in the batched series of profiles. The SEARCH command had to be provided in order to initiate the search otherwise the procedure would only verify the terms used and output appropriate messages concerning the profile.

On the first page of output the question number, date, heading for the question, and the name and address of the user was printed. The print-out of the search profile and the appropriate bibliographical response followed. If the response continued on subsequent pages, the question heading began each new page of bibliographical information. The first page of output did not include the address of the user if the question was the second or more in a series submitted by the same user.. A single machine card was punched with the document reference code corresponding to each hit in the response. The program procedure SEARCH performed the above operations.

System Feedback

The output for a given user's request could immediately be sent to the user. The user had the opportunity of selecting the appropriate references, and returning the corresponding machine cards for document retrieval. Prior to sending the machine cards to users, the cards were tallied so that a record was kept of the frequency a given document was found in the searches performed. Upon return of the cards for document

retrieval, the cards were again tallied so that the frequency found could be compared with the frequency a given document is requested and used. This information provided data on the relevance of information in the system, as well as some indication of the needs of the users. The program TALLY provided the procedure for counting machine cards, for each document in the system, and printing the current tally.

System Evaluation

A selection of 20 potential users of the system were requested to structure questions to be put to the system. These users participated in the formulation of two different search profiles on different topics. The questions were structured knowing the general content of the main file but with no knowledge of the actual number of documents which should be output. The users were given a brief explanation of the search procedure and were shown sample search profiles. Knowing the searching possibilities, they were asked to structure the questions. The response to 20 questions yielded data which could be employed in calculating the mean recall and precision ratios for the system. The average search time for the system, the user effort, and the user comments were also recorded. The indexing procedure was evaluated and the man-hours to perform this operation were recorded.

CHAPTER IV

DETAILS FOR USE OF THE PROGRAMS

The Pre-File Phase

The program PRE-FILE reads the number of thesaurus terms, the card deck of thesaurus terms, the number of profiles and the input profile cards to be entered to the system. The program verifies the descriptors in the profiles and prints the entire citation record which is 258 bytes in length.

Prior to the running of the FILE program, all profiles may be checked in this manner for errors in the citation information or in the descriptor record. The print-out is checked manually, all errors are corrected, and the PRE-FILE program is run a second time. This procedure is repeated until all errors have been eliminated.

The number of profiles run at any one time should not be more than 100 so that the manual checking procedure can be effective. The thesaurus used in the pre-file phase is identical to that used in the FILE program.

The job should be submitted with a time limit of 2 minutes, and the number of lines required should have as its limit 4000 lines when 100 profiles are processed.

The flow diagram of the PRE-FILE computer procedure is given in Appendix F. The source listing of the program PRE-FILE is given in Appendix G, and the arrangement of control cards is illustrated in Figure 10.

The File Phase

The program FILE reads the number of thesaurus terms, the card deck of thesaurus terms, the cards containing the caretaker file information, the number of profiles and the input profile cards to be entered to the system. The program verifies the descriptors in the profiles, creates the files or adds to the existing files, and prints the citations.

It is necessary to write skeletal records in storage upon initially creating the file. The source listing of the program FILE (Appendix G) identifies the portion of the program which must be contained on the initial create operation, and removed on subsequent jobs when the additions or updates are made to the file. The control cards necessary on the initial create operation would differ from those employed on subsequent jobs when updates or additions are made. The initial create job requires the job step to copy the inverted and citation files from disc to tape at the end of program execution. Subsequent file jobs require the opening step of copying the files from magnetic tape onto disc storage before the program can be executed.

The program FILE handles the total filing procedure, and the current caretaker files must always be input with this job. If any term error has occurred in the input profiles, the program will point out the error, and only file those document entries which have been verified as correct. The program writes the files by the random access method, and the organization of the inverted file disc space follows. The program writes the new record on the physical record, and the write begins at the next physical record if enough space for the logical record is not available on the current physical record. Therefore, in creating logical records, there is no continuation

on successive physical records. The size of any record is limited to the length of the one physical record. However, the program procedure writes, or adds to, an existing logical record and overflows, or chains, if there is insufficient space available in the logical record. In this case the size of any one record is limited by the length of one physical record, and the size of the initial record in the inverted file. If overflow is necessary on any given file operation, the program demands that on any subsequent file operation the entire files be recreated with an increase in the space for all records. This change may be made by altering the update record in the caretaker files. This built-in procedure keeps the number of overflow records to a minimum, therefore the resulting efficiency of the file maintains optimum search time. The citation file is organized on disc space sequentially, although all records are written by direct access.

A total of 100 profiles should be input on the initial operation of the FILE program which will open and create the files. The caretaker files used on the initial run are illustrated in Figure 11, including the update record, location records, number of elements records, and space available records. There should be a five column card field for each thesaurus term over each of the latter three records noted above.

After the initial job to create the inverted and citation files, the program can be utilized to make additions of up to 100 input profiles on any subsequent job. The current caretaker files (output from the previous file job) must be used in any file operation which follows the initial job, and they are output in the form of punched cards.

The job should be submitted with a time limit of 4 minutes, and

FIGURE 10

THE ARRANGEMENT OF CONTROL CARDS
PROGRAM PRE-FILE

The following arrangement follows the JOB card

```
// TERMITT EXEC FORTGLG
```

```
// LKED.SYSIN DD *
```

The Object Deck of Program

```
/*
```

```
//GO.FT01FO01 DD UNIT=SYSDA, DISP=NEW,  
//          SPACE=(7224,50),  
//          DCB=(RECFM=FB, LRECL=258, BLKSIZE=7224)  
//GO.SYSIN DD
```

The Thesaurus and Input Profile Deck

```
/*
```

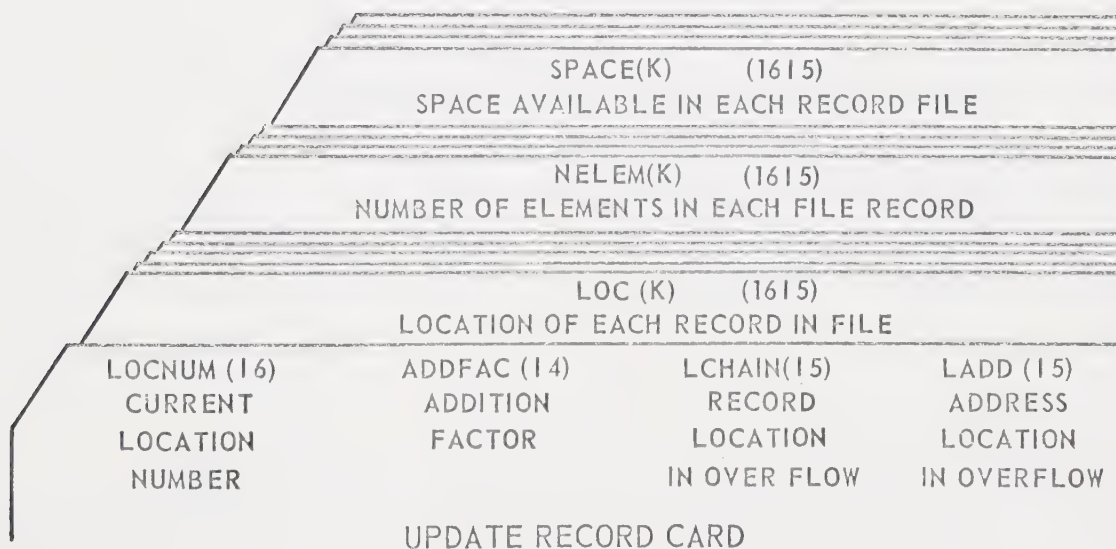


FIGURE 11: THE CARETAKER FILES CARD RECORD FORMAT

the number of lines required should have as its limit 4000 lines when 100 profiles are processed.

The flow diagram of the computer procedure is given in Appendix F. The source listing of the program appears in Appendix G, and the arrangement of the control cards is illustrated in Figure 12. The schematic diagram of the file procedure appears in Figures 13 and 14.

The Search Phase

The program SEARCH reads the number of thesaurus terms, the card deck of thesaurus terms, the cards containing the caretaker file information excluding the first update record card, the date of the search and the series of one or more search profiles. The program verifies the descriptor terms in the search profiles, and searches the system inverted files for the document hits. Although the questions are run in the batch environment, each is handled separately for all operations of the program. In this manner, a serious error occurring in any one question will not interfere with the execution of any other search profile.

If author-terms have been used in any search formulation, the procedure searches the citation file records which have been established after the inverted file search. It is only possible to search authors if a previous descriptor parameter is used to reduce the number of citation records to be searched.

Although it is possible to search any part of the author-field, if author initials are not included it is possible to retrieve irrelevant information. That is, if the author term "Smith" is used, related documents by "Smithers" will also be found. In order for the search of the inverted

FIGURE 12

THE ARRANGEMENT OF CONTROL CARDS

PROGRAM FILE

The following arrangement follows the JOB card

```
// COPYIF EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT1 DD UNIT=SYSTP, DIP=OLD, DSN=IFILE,
// VOLUME=(,RETAIN,SER=T00027)
//SYSUT2 DD UNIT=SYSDA, DIP=(NEW, PASS), SPACE=(CYL,1)
// DCB=(RECFM=F,LRECL=7292,BLKSIZE=7292)
//COPYCF EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSUT1 DD UNIT=SYSTP, DISP=OLD, DSN=CFILE, LABEL=(2,SL)
// VOLUME=(,RETAIN,SER=T00027)
//SYSUT2 DD UNIT=SYSDA, DISP=(NEW,PASS), SPACE=(CYL,2)
// DCB=(RECFM=F,LRECL=258,BLKSIZE=258)
```

The above statements are removed one the initial job

```
//TERMITT EXEC FORTGLG
//FORT.SYSIN DD
```

The Object Deck of Program

```
/*
//GO.FT02F001 DD DSN=*.COPYIF.SYSUT2, DISP=(OLD,PASS)
//GO.FT01F001 DD DSN=*.COPYCF.SYSUT2, DISP=(OLD,PASS)
```


The last two statements are replaced by the following four on the
initial job

```
//GO.FT02F001 DD UNIT=SYSDA,DISP=(NEW,PASS),SPACE=(CYL,1),
//
//          DCB=(RECFM=F,LRECL=7292,BLKSIZE=7292)
//GO.FT01F001 DD DISP=(NEW,PASS),UNIT=SYSDA,SPACE=(CYL,2),
//
//          DCB=(RECFM=F,LRECL=258,BLKSIZE=258)
//GO.SYSIN DD *
```

The Thesaurus Caretaker Files (including update card), and Input
profile Deck

```
/*
//IFOUT EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSUT1 DD DSNAME=*.TERMITE.GO.FT02F001,DISP=(OLD,DELETE)
//SYSUT2 DD UNIT=SYSTP,DISP=(NEW,KEEP),DSNAME=I FILE,
//
//          DCB=(RECFM=F,LRECL=7292,BLKSIZE=7292),
//
//          VOLUME=(,RETAIN,SER=TOOO27)
//CFOUT EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT1 DD DSNAME=*.TERMITE.CO.FT01F001,DISP=(OLD,DELETE)
//SYSUT2 DD DCB=(RECFM=F,LRECL=258,BLKSIZE=7740),LABEL=(2,SL),
//
//          VOLUME=(,RETAIN,SER=TOOO27)
/*
```

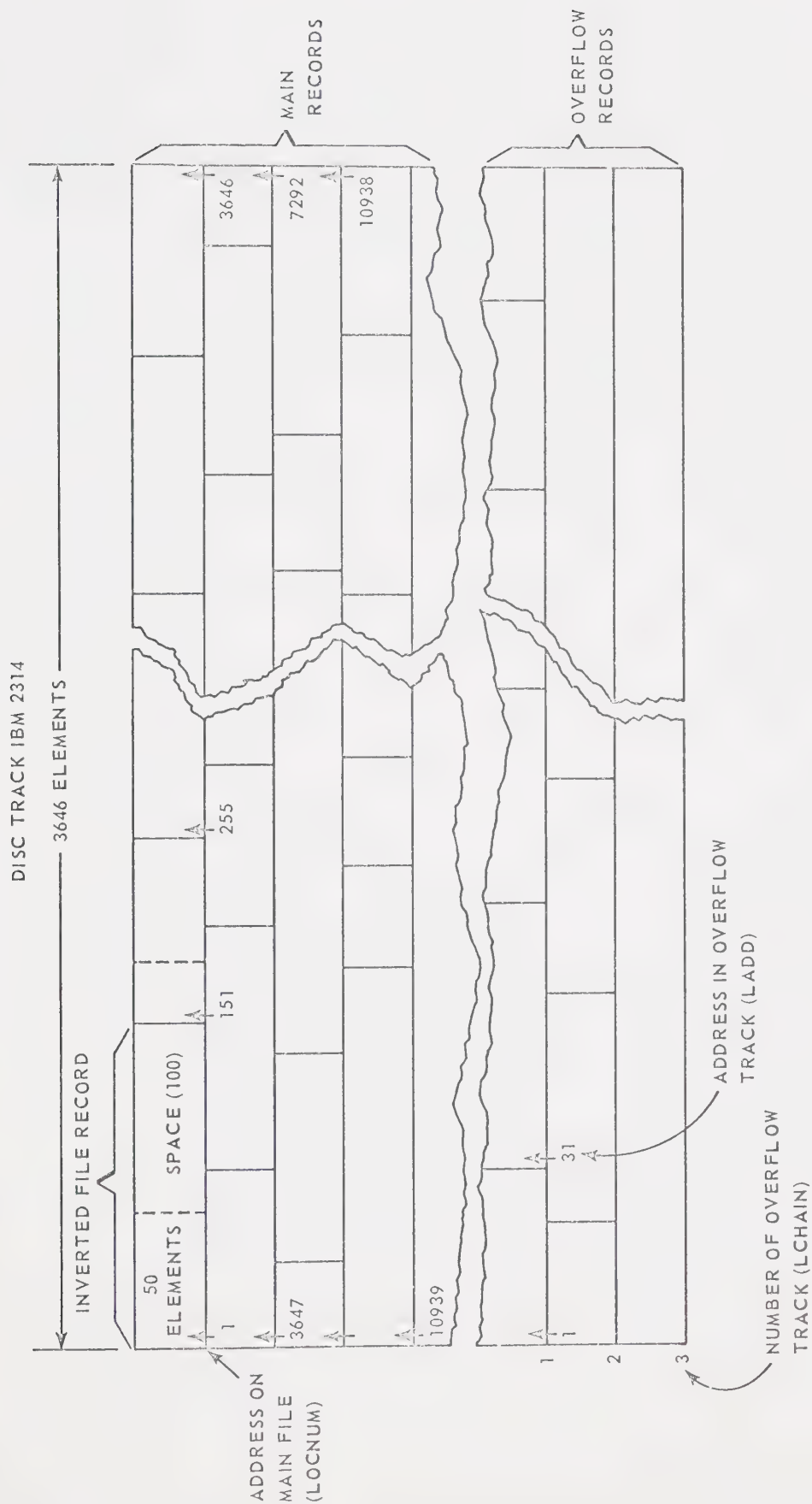
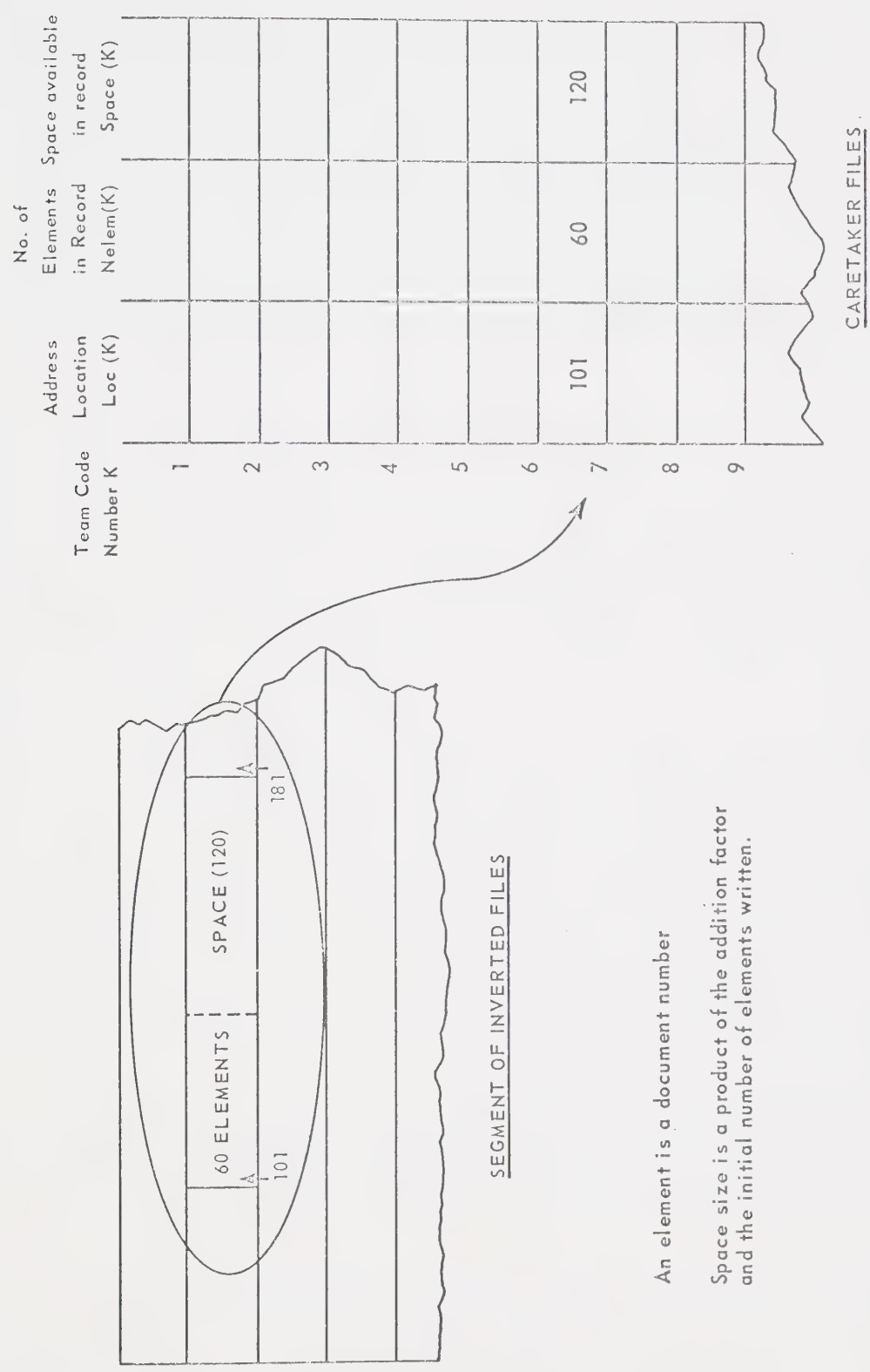



FIGURE 13: SCHEMATIC DIAGRAM OF INVERTED FILES



An element is a document number

Space size is a product of the addition factor and the initial number of elements written.

FIGURE 14: SCHEMATIC DIAGRAM OF CARETAKER FILES

and citation files to proceed following each profile or question, the command SEARCH must be included at the end of the profile. If this card does not appear in the profile the terms of the profile will be verified, but no searching of the main files will take place and therefore no document hits will be printed. The program SEARCH prints the headings, the user's name, the search profile input, and follows with the print of all the citations found. If errors occurred in the search profile, the appropriate messages are printed. Also a machine card is punched for each document output. The machine card format is illustrated in Appendix C.

There is no finite limit to the number of search profiles that may be run at any one time. The thesaurus used in this computer procedure should be the current thesaurus which has been used in the pre-file and the file phases.

The search job should be submitted with a time limit of 3 minutes, and the number of lines required should have as its limit 5000 when upwards to 30 questions are being processed. The time required is a function of the complexity of the questions, while the number of lines necessary is governed by the output expected from the questions put to the system.

The control cards necessary for the search operation include the initial steps of copying the files from tape onto disc. At the termination of the search, the files are copied from disc onto magnetic tape.

The flow diagram of the SEARCH computer procedure is given in Appendix F. The source listing of the program SEARCH appears in Appendix G, and the output from the search is illustrated in Figure 15. Arrangement of the control cards, for this program is illustrated in Figure 16.

ALBERTA INFORMATION RETRIEVAL FOR HEALTH
PHYSICAL EDUCATION AND RECREATION

DATE 20/01/70

QUESTION NO. 3
BLOOD PRESSURE AND EXERCISE AMONG MALES, ARTICLES WRITTEN SINCE 1967

NADINE MOYER,
#210 10840 81 AVENUE,
EDMONTON 60, ALBERTA

AND
D BLOOD PRESSURE
D BLOOD MEASURES

AND
D 1967
D 1968
D 1969

NOT
D WOMEN

00122-MOORE RD

MOORE R.D.
RESISTANCE AMONG BOYS
FACTORS INFLUENCING TOTAL PERIPHERAL

DISS., UNIV. OF ILLINOIS 1967
QP 101 PE MICR

00156-BLOOMFIELD

BLOOMFIELD J.
BETWEEN THREE GROUPS OF SWIMMERS OF VARYING ABILITIES
ANATOMICAL AND PHYSIOLOGICAL DIFFERENCES

DISS., UNIV. OF OREGON 1967
GV 837 PE MICR

FIGURE 15 SAMPLE SEARCH OUTPUT

FIGURE 16

THE ARRANGEMENT OF CONTROL CARDS

PROGRAM SEARCH

The following arrangement follows the JOB card.

```
//COPYIF EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD UNIT=SYSTP,DISP=OLD,DSNAME=IFILE,
// VOLUME=(,RETAIN,SER=TOOO27)
//SYSUT2 DD UNIT=SYSDA,DISP=(NEW,PASS),SPACE=(CYL,1),
// DCB=(RECFM=F,LRECL=7292,BLKSIZE=7292)
//COPYCF EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=A
//SYSIN DD DUMMY
//SYSUT1 DD UNIT=SYSTIP,DISP=OLD,DSNAME=CFILE,LABEL=(2,SL),
// VOLUME=(,RETAIN,SER=TOOO27)
//SYSUT2 DD UNIT=SYSDA,DISP=(NEW,PASS),SPACE=(CYL,2),
// DCB=(RECFM=F,LRECL=258,BLKSIZE=258)
//TERMITT EXEC FORTGLG
//LKED.SYSIN DD *
```

The Object Deck of Program

```
/*
//GO.FT01F001 DD DSNAME=*.COPYCF.SYSUT2,DISP=(OLD,PASS)
//GO.FT02F001 DD DSNAME=*.COPYIF.SYSUT2,DISP=(OLD,PASS)
//GO.SYSIN DD *
```

The Thesaurus, Caretaker Files (without update card), the Date Card,
and the Deck of Search Profiles

```
/*
```


The Tally of Documents

The program TALLY reads the number of documents in system, the date and label and the card deck of cumulated totals for each document in the system, and reads each of the machine cards output from the SEARCH program. This tally procedure adds the number of cards for each document to the current cumulated total. After completing this totalling procedure the program punches the cumulated total for each document number on cards in five column fields, and prints the current cumulated totals. It is therefore possible to keep the tallies for the number of times a given document is hit over a number of questions, a separate tally for the number of times a given document has actually been requested.

The card deck of cumulated totals varies in size with the number of documents currently in the system. The cards output from the SEARCH program may be entered in any order, and the program will process up to 1000 cards within the 2 minute time limit. The number of lines required should have as its limit one-fifth of the number of documents in the collection. That is 1000 lines would be sufficient for 5000 documents in the collection.

The flow diagram of the program TALLY is given in Appendix F. The source listing of the program TALLY appears in Appendix G, while the arrangement of control cards appears in Figure 17.

The Print-Out of the Library

The program LIBRARY reads the magnetic tape citation file. The program procedure prints each document citation in the file, until the end of the file has been reached.

This program can be used to check the contents of the citation file and may be useful by the users and managers of the information file. -

The number of records read in the citation file has no finite limit, except the length of the magnetic tape. The job should be submitted with a time limit of three minutes, and the number of lines required is ten times the number of documents in the system.

The flow diagram of the LIBRARY computer procedure is given in Appendix F. The source listing of the program LIBRARY appears in Appendix G, while the arrangement of the control cards is illustrated in Figure 18.

System Library Programs

The following programs, which are part of the system library at the Computing Centre, University of Alberta, were employed as sub-programs: BISORT, ICM PAR, and IMOVE¹. The source listings of the programs appear in Appendix G.

The Computer Hardware

All computer jobs for this prototype information retrieval system were handled by the University of Alberta Computing Centre. The system installed at this centre is the IBM 360 model 67, and the configuration relevant to this project is outlined below.

The main frame consists of the central processing unit 2067-1, three core storage units 2365-2(768K storage), and the operators console 1052.

¹The author wishes to thank Frank Jacobsen for permission to use these computer programs.

The system input output devices include the line printer 1403N1 (1100 lines/minute), the card read/punch unit 2540 (reads 1000 cards/minute, punches 300 cards/minute), and the print read control unit 2821.

The auxiliary storage devices used include the direct access storage unit 2314 which contains eight separate disc drives. Each disc drive has a storage capacity of 28 million characters. The magnetic tape drive 2400-2 employed is a 9 track unit. The tape control unit 2803 completes the description of the auxiliary storage devices.

FIGURE 17

THE ARRANGEMENT OF CONTROL CARDS

PROGRAM TALLY

The following arrangement follows the JOB card.

```
//TERMITT EXEC FORTGLG
```

```
//LKED.SYSIN DD *
```

The Object Deck of the Program

```
/*
```

```
//GO.SYSIN DD *
```

The Cumulated Totals Card Deck and Tally Cards

```
/*
```

FIGURE 18

THE ARRANGEMENT OF CONTROL CARDS

PROGRAM LIBRARY

The following arrangement follows the JOB card.

```
//TERMITT EXEC FORTGLG
```

```
//LKED.SYSIN DD *
```

The Object Deck of the Program

```
/*
```

```
//GO.FTO1FOO1 DD UNIT=SYSTP,DISP=OLD,DSNAME=CFILE,LABEL=(2,SL,,IN),
```

```
// VOLUME=SER=TOO027
```

```
// DCB=(RECFM=F,LRECL=258,BLKSIZE=258)
```

```
/*
```


CHAPTER V

THE EVALUATION OF THE SYSTEM

User Request and Retrieval

A group of nineteen physical education graduate students and one physical education faculty member were selected as potential users, and requested to structure questions to be put to the system. These users participated in the formulation of at least two different search profiles on a topic of interest to the user. The questions were structured knowing the general contents of the main file, but with no knowledge of the actual number of documents which might be output as a response.

The users had no previous experience with this system, or any similar information retrieval system. It was therefore necessary to briefly explain the searching procedure, and the principle of employing Boolean operators to manipulate the precision of the search. Sample search profiles were also explained, and questions concerning the samples were discussed. It was necessary to describe the use of the controlled vocabulary, and to familiarize the users with the system thesaurus. Users were also informed that the system was capable of searching authors as well as descriptors. Following this period of introduction, the users were requested to formulate questions and then to commence the structure of two search profiles. The profiles were to be completed on the same topic, but took the following forms: the first was to be a general question on the topic, low in precision, and producing a number of bibliographical hits; the second profile was to be

specific, high in precision, and therefore producing a reduced number of bibliographical hits. The type of guidance given the users was of a consultative nature. Questions were answered, and these usually took the form of reviewing the principle of Boolean operators, and thereby informing the user of the relevancy of his profile structure in light of the question asked. The tester made every attempt to leave the structure of the profile to the user, answered questions, and assisted the user in employing the thesaurus to find desired terms. The users were encouraged to formulate any other questions for which they might wish to gain a response.

The profiles formulated by the twenty users were key punched and run in the computer job SEARCH. The search response was given to the user on the second meeting, and the user was also supplied with a complete listing of the contents of the system library, or citation file. The user manually reviewed the library for the references relevant to the questions asked. The search output received could then be compared with the references deemed relevant to the question. Only those profiles agreed to be representative of the questions asked were used in the data for the system evaluation.

The recall and precision percentages were calculated for each user, and the mean values over the twenty users were also recorded. The formulae employed are given below:

$$\begin{aligned} \text{Recall (\%)} &= \frac{\text{No. of Relevant Retrieved}}{\text{Total Relevant in Collection}} \times 100 \\ \text{Precision (\%)} &= \frac{\text{No. of Relevant Retrieved}}{\text{Total Number Retrieved}} \times 100 \end{aligned}$$

The results of the testing appear in Appendix D, and the recall percentages

vary between 50% and 100% with the mean recall 80.55%. The precision percentages vary between 80% and 100%, with the mean precision at 98.60%.

During the testing procedure, the users were requested to comment regarding the difficulty of formulating the search profile. The user effort was observed during the actual profile structure where an understanding of the principle of the Boolean operator was necessary, and where some familiarity with the thesaurus was also helpful. The tester found that the users had little effort understanding the principle of formulating a search profile, and that they found the thesaurus complete on many topics. It was evident that as experience with the thesaurus continued, the user was more capable of quickly making a search profile.

The time lag between search formulation and search response was as short as two hours, and the longest was twelve hours. The format of the search print appeared clear and meaningful to the user.

The Indexing Procedure

The indexer averaged 16 minutes per document in completing the indexing procedure. This figure includes all aspects of completing the indexing coding form, and assigning the descriptor terms to the document. This average time was calculated after the indexer had completed 25 documents, and was therefore familiar with the procedure.

Key Punching

The total cost for key punching and verifying the 300 input profiles was 16 hours (\$44.00). This resulted in a mean cost of .053 hours (\$0.15) per document input profile. This cost figure is based upon \$2.75

per hour for key punching and verifying.

The following analysis covers the important computer job operations of the prototype system, AIRHPER, and the costs are calculated based on the computer charge of six dollars (\$6.00) per minute.

The Pre-File Phase

The total job time required to process 100 documents was 1.19 minutes, and a cost of \$7.14 (or .012 minutes, \$0.08 per document). The number of man-hours to correct errors in the profiles could not be evaluated, however, the time to correct 100 documents was very minimal.

The computer storage region necessary for the program PRE-FILE was 96K.

The File Phase

The total job time required by FILE to process 100 documents on the initial create job was 3.96 minutes or a cost of \$23.76. The total time required to process 100 documents on subsequent runs was 3.55 minutes, at a cost of \$21.30.

The actual execution time to process 100 documents after the initial job was 2.89 minutes, and this amounted to .029 minutes per document. The remaining time was overhead time, necessary to all file procedures regardless of the number of documents input. This time is made up of the steps to copy the files from tape to disc, to link-edit, and to copy the files from disc to magnetic tape at the end of execution.

The computer storage region necessary for the program FILE was 106K.

TABLE I
SUMMARY OF PREPARATION AND FILE COSTS PER DOCUMENT

	Time	\$
Indexing	.266 hours	1.30*
Key punching	.053 hours	0.15
Pre-File Phase	.012 minutes	0.07
File Phase	.035 minutes**	0.22
Total		1.74

* estimated indexing cost \$5.00 per hour

** includes overhead charges

The Search Phase

The overhead time necessary to operate the SEARCH program regardless of the number of questions was .43 minutes, representing an initial cost of \$2.58. The time to execute a search on a single question varies as the complexity of the question and the use of author terms. A question having up to four parameters, with twelve descriptor terms and no author terms, will execute in a time up to .06 minutes. This represents a cost of approximately \$0.36. A similar question employing authors to gain the same output will execute in a slightly shorter period, up to .05 minutes.

CHAPTER VI

SUMMARY AND CONCLUSIONS

Summary

The purpose of this study was to design and test a prototype information retrieval system for health, physical education and recreation capable of retrieving desired references to documents useful in the field, and making such information available to users. The references were retrieved using descriptor and author terms, or combinations of these.

The system was also designed so that information could be added and updated at regular intervals. It was designed to be adapted to the on-line system installed at the University of Alberta Computing Center, and a mechanized medium for recording user feedback and document relevance was also included in the system design.

The updating and expansion of the thesaurus for health, physical education and recreation was also a significant part of this study. A manual indexing procedure was used to describe the information content of the documents, and prepare the bibliographical material for input.

The data base was limited to 300 documents, and these were theses and dissertations written in the last 25 years and stored in the physical education library and the University of Alberta.

Conclusions

The evaluation of the information system by the group of twenty

users provided the data necessary to conclude that the system, AIRHPER, can be employed by physical educators to retrieve bibliographical information on a wide variety of topics in the field. The use of descriptor and author terms were effective in producing an average recall of 80.55 percent of the desired documents in the collection, and of those actually retrieved the average precision was 98.60 percent. The user effort indicated that the structure of search profiles or questions was readily learned, and that with little experience in formulating questions, users can become proficient.

The machine search response varied according to the complexity of the question, although all searches performed in all test operations had a response time between three and six seconds (.05 to .10 minutes). This time does not include the reported overhead time for the job, however, the response times appear sufficient for program adaption to on-line facilities. File management and maintenance was also designed to keep response time at a minimum.

The source language, Fortran IV G, was employed as the current capability for on-line facilities at the University of Alberta utilizes this computer language. The use of direct access in constructing the files, and the inclusion of the inverted file design makes the system adaptable to on-line at the University of Alberta. The design of the search profile format also involved easy adaption to the on-line system.

The design of the file program using direct access storage facilities the filing and updating procedure. Documents, previously assigned system numbers, can be filed in any order and the file job will execute in the appropriate order. The documents which have not been

corrected in the pre-file phase will not be inadvertently filed by the system. It is therefore possible to correct the profiles and file them on a subsequent job in the appropriate order in the citation file. New documents are readily added to the end of the citation file.

The output of the tally card in the search job, and the use of the computer job TALLY, provided an effective means of maintaining useful data concerning the relevance of the information on file. Any information system must contain relevant material as well as information which can be acquired rapidly. The data may be used to maintain the files with information relevant to user needs.

The system evaluation indicated that the manual indexing procedure was an effective means of describing the information content of a given document. It was possible to index content which was not necessarily described in the document title. Although the indexing procedure was structured, the indexer was required to make judgements in the indexing of most documents. It is therefore necessary that the indexer is familiar with the subject field, and also conversant with the terminology of the field. Although the indexer may be familiar with the thesaurus, it is essential that the thesaurus be consulted with every document such that the cross-references listed in the thesaurus are used in the indexing procedure. There are terms in the thesaurus which must only be used according to the attached scope notes, and therefore constant consultation of the authorized word list is imperative.

The Thesaurus for Health, Physical Education and Recreation was built to a size of 665 terms, and throughout the indexing procedure further cross-reference work was undertaken. The user request and retrieval testing indicating that the present thesaurus was most adequate in a variety of

areas of the field.

The program LIBRARY was a useful tool in providing the print of the system citation file for testing purposes. Such a facility is also most helpful for file management.

The AIRHPER prototype system is essentially limited by the use of any one descriptor term at a frequency of 3646, on the storage device employed. Therefore if one term is used in describing the information content of every document in the system, the limit to the number of documents is 3,646. However, based on the use of the most frequent term in the 300 documents in the prototype system, the number of documents would be limited between 15,000 and 20,000.

The cost analysis for the operation of the prototype system indicates that one dollar and seventy-four cents (\$1.74) must be allocated for the indexing, key punching, pre-file checking, and filing. Of this amount, twenty-nine cents (\$0.29) is necessary to pay computer charges at six dollars (\$6.00) per minute, fifteen cents (\$0.15) is required for key punching and verifying at the rate of two dollars and seventy-five cents (\$2.75) per hour, and finally one dollar and thirty cents (\$1.30) is required for indexing at a rate of five dollars (\$5.00) per hour.

The searching of the system files for the response to a single question may be performed for between thirty and seventy cents (\$0.30 to \$0.70), and if overhead job time is included in this figure, the cost would be between fifty cents and one dollar (\$0.50 to \$1.00). The variance in the figures is a result of the complexity of the questions.

Recommendations for Changes

1. The improvement of the indexing procedure necessitates that a greater number of scope notes be employed in the system thesaurus, providing strategic information in the employment of the terms.

In addition to the publication year and the dates of the content material, the indexer should consistently record the age group of the subjects involved in the information. The sex of the subjects involved should also be recorded if they are only male or only female, otherwise no indexing reference to sex should be made.

Whenever a group of indexers are involved in contributing to the system, it will be necessary to coordinate their work and maintain a consistent indexing procedure.

2. The procedure for controlling the growth of the system thesaurus should be carefully designed. The size and relevance of the thesaurus is a most important aspect of the system.

3. The costs to operate the system may be reduced by eliminating the pre-file phase. The system file phase will perform the checking, and the input profiles may be entered directly into the files.

4. The system should be adapted to the on-line facility at the University of Alberta. Exploratory work should be performed on filing and updating the system files utilizing the on-line capabilities.

5. The prototype system file structure may be altered to increase the system capacity.

6. The system should be further developed to control research and non-research information in the field of health, physical education and recreation. This may be done by producing system magnetic tapes at a central location, and making such tapes available to the centres interested in the retrieval of information in the field. Such local centres would employ the system search procedure, and operate their own operation. The document information may be housed in a central location or it may be stored in different location across the country. Information may be contributed to the central location by users in the local centres.

The cost of operating such a system would make it possible for many university departments and school boards to employ this search and retrieval system.

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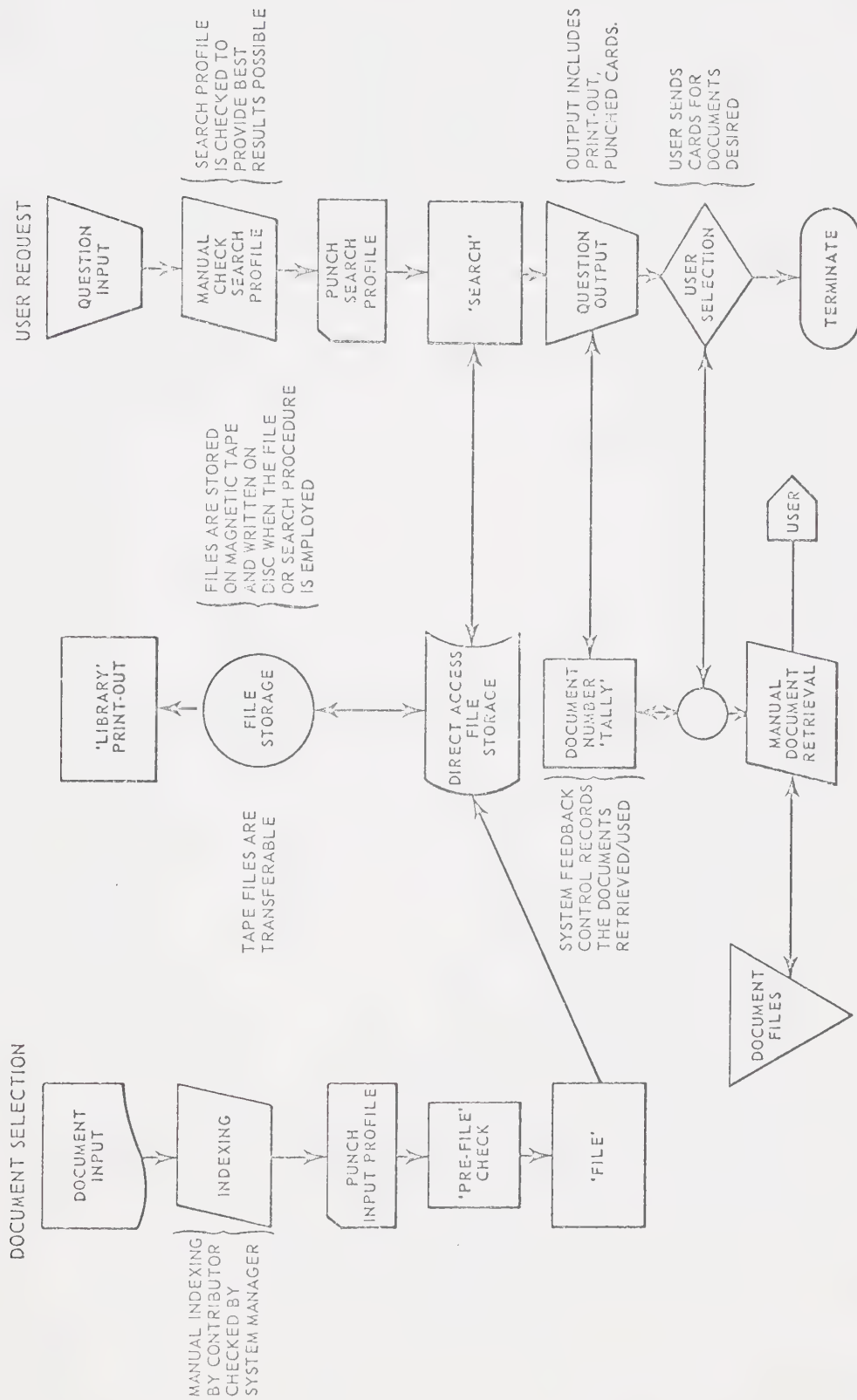
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APPENDIX A

The AIRHPER System

ALBERTA INFORMATION RETRIEVAL FOR HEALTH, PHYSICAL EDUCATION AND RECREATION



APPENDIX B

The Indexing and Question Coding Form

Date: / /

AIR H P E R
Question Coding Form

Page _____ of _____

1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
A G A I N																
T I T L E																
(Print an appropriate title to the question - Circle "AGAIN" if other than first question)																
F O R																
(Name)																
(City and Province)																
SEARCH PROFILE:																
PROFILE INSTRUCTIONS																
1. Each new parameter begins with "AND" or "NOT".																
2. Descriptor parameters precede Author parameters. There must be one descriptor parameter.																
3. Using Author parameters, "AND" precedes "NOT", also only one "AND" or one "NOT" is permitted.																
4. Maximum 10 parameters Maximum 25 terms in each parameter																
5. The identifier "A" or "D" must be included with each term. Conclude profile with "SEARCH".																
Statement of Question:																

APPENDIX C

The Machine Card Profiles

SEARCH

A BELL

A SONGS D. J.

AND

A PRESCHOOL

A PRIMARY

A ELEMENTARY

AND

A CREATIVE MOVEMENT

A RHYTHMICS

A DRAMATICS

A DANCE

AND

A TEACHING ACTIVITY

AND

AND U.S. LETTERS

426 MICHELER PARK,

EDMONTON, ALBERTA

CHILD TEACHING BOARD AT THE ELEMENTARY AND PRIMARY SCHOOL LEVELS

24/5/2027 23:29:51

A

B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

THE SEARCH PROFILE

APPENDIX D

The Search Testing Results

DATA SHEET - AIRHPER TESTING

User	Total Relevant in Collection	Total Found	Relevant Found	Recall %	Precision %
1	5	5	5	100	100
2	4	3	3	75	100
3	2	1	1	50	100
4	4	3	3	75	100
5	5	5	4	80	80
6	0	0	0	100	100
7	2	1	1	50	100
8	3	2	2	67	100
9	5	5	5	100	100
10	0	0	0	100	100
11	4	3	3	75	100
12	1	1	1	100	100
13	3	3	3	100	100
14	0	0	0	100	100
15	14	12	11	79	92
16	2	1	1	50	100
17	1	1	1	100	100
18	2	1	1	50	100
19	7	7	7	100	100
20	5	3	3	60	100
Mean				80.55	98.60

APPENDIX E

The Thesaurus

A THESAURUS FOR HEALTH, PHYSICAL EDUCATION
AND RECREATION

By H. N. Watts

THE UNIVERSITY OF ALBERTA

1969

PREFACE

Physical education is a rapidly growing field of knowledge, and like many subject fields today it is faced with the problem of efficiently storing and disseminating information. Manual indices remain useful tools for searching, however, exhaustive searching procedures along varying dimensions may be handled more effectively by the computer and a co-ordinate index system.

The purpose of this project was to develop an index of concepts and keywords used in the field of physical education. Such an index is used in the tagging of documents for input into an information retrieval system for physical education. Such a retrieval system utilizes a concept co-ordinate system of search.

The index, or thesaurus, was constructed for use by physical educators, health educators, and recreation specialists working in the field. The index was developed for use in the design of an information retrieval system¹ employing computers, which was completed by this investigator at the Faculty of Physical Education, University of Alberta.

The index includes concepts describing many areas of the field of knowledge. Although the descriptors or concepts are capable of indexing most documents in the field, no attempt is made to develop concepts describing the detail of any one area of the field.

¹Information Retrieval system is to mean a document retrieval system where the reference information is stored and made available.

The methods used in the development of this thesaurus were such that the opinions and specific terms suggested by other physical educators are included. A thesaurus must be practical and meaningful to many physical educators, health educators and recreation specialists.

THE THESAURUS

Though the the thesaurus is designed primarily for co-ordinate indexing systems, it may be used in traditional subject heading systems, such as library card catalogues or printed subject indexes. The essential difference between subject headings and co-ordinate indexing systems is that combinations of terms in subject headings are fixed at the time of indexing, whereas terms in co-ordinate indexing systems are manipulable at the time of searching, enabling the individual looking for information to co-ordinate several terms simultaneously in any desired combination.

The Format

The thesaurus consists of three sections:

(1) introduction, (2) rules and conventions, and (3) alphabetic listing of descriptors and cross references.

1. Introduction: This section presents the thesaurus philosophy and explains how the thesaurus is to be used in indexing and searching.

2. Thesaurus Rules and Conventions: The rules and conventions used in constructing the thesaurus are also presented. Examples of the notations used and of the ways terms are treated are given in the descriptor displays.

3. Alphabetic Section: The alphabetic section is the core display of the thesaurus. It is an alphabetical list of all terms in the thesaurus.

- a. USE references are interfiled with the descriptors. Other appropriate cross references are indented under the descriptors to which they refer.
- b. Scope notes are entered for descriptors whose meanings need to be clarified.
- c. To enhance the retrieval capabilities of the vocabulary, a limited number of terms representing general or abstract concepts are established descriptors. These descriptors are chosen for their ability in delimiting, explaining, or modifying the treatment of the subject matter described. Examples are:
psychology, physical education, education, recreation, health
education, history, physiology. To help develop consistent and appropriate use of these types of descriptors, special indexing instructions will be provided accompanying these terms.

Figure 1 illustrates the various elements of the alphabetic section.

Figure 1.

Illustration of Notation

USE reference	Accident Prone	not authorized descriptor
	USE Accidents	Descriptor
descriptor	Accidents	
scope note	(relating to participation in athletic activities)	
USED FOR	UF Accident Prone	not authorized descriptor
NARROWER TERMS	NT Accident Liability) Accident Frequency) Accident Causes) Accident Insurance)	descriptors
BROADER TERMS	BT Safety)	
RELATED TERMS	RT Injuries)	

SECTION I

Introduction

The natural language used by the authors of documents contains a great many words whose meanings overlap to varying degrees. The aim of a controlled retrieval language is to concentrate the multiplicity of words, with overlapping meanings, into a smaller set of descriptors with more precisely defined and delimited meanings. This controlled vocabulary can be utilized in the indexing of documents, and in the formulation of a search request which can be put to the information system. The terms tagging a given document in the system should describe the information concepts displayed in the document. Likewise, the terms which best describe the information required should form the profile of the search. If the generic and specific terms used in the system or thesaurus are common and understood by the majority in the field, then those terms used at the time of indexing will be nearly congruent with those chosen at the search time.

The following examples illustrate the use of the thesaurus in the indexing of documents to be input to the system. The format for utilizing the thesaurus in the search request follows this converse process of indexing.

In preparing to index a given document the initial procedure is to very briefly abstract the article describing its informational content in relation to the field of health, physical education, and recreation. The title of the document may or may not provide enough information as to the contents of the specific document or paper. In the majority of cases it will be necessary to scan parts or the complete document, in order that it may be indexed according to its true informational content.

Having formulated a brief abstract of the information, the next step would be to choose descriptor terms which best indicate the concepts displayed

in the document. Each term selected must be found in the thesaurus, and the structure of the thesaurus will provide leads to related terms which may also be used. The descriptors chosen as suiting the information content best must agree EXACTLY with the thesaurus.

The system of searching for the indexed documents pertinent to a request involves the matching of the terms used in the search with the documents which have been tagged with these terms. However, it should be pointed out that not all terms appearing in the search request must be found on a given document before it is output. The number of terms needed to satisfy the request may be altered.

Examples of documents indexed

1. Physical Education/Programs/Secondary/Boys/Evaluation/Administration/
1947 (descriptor terms)

Minnegan, Donald I. Criteria of a Good Physical Education Program
for Boys in Senior High School. Unpublished doctoral diss.
George Wash. Univ. 1947.

N.B. The term Physical Education is a very general term, and should be used only to complement another term used (e.g. Program), or for some other distinguishing reason. The term Administration is used as it is thought relevant to this information.

2. Weight Training/Strength/Leg/Jumping/Endurance/1956 (descriptor terms)

Ness, Philip E. and Sharos, Charles L. The Effect of Weight Training
on Leg Strength and the Vertical Jump. Unpublished thesis, Springfield College, 1956.

N.B. The term Endurance is not evident from the title, however, after briefly abstracting the document, it was found to be a necessary term.

3. Oxygen Uptake/Body Density/Weight/Men/Fat/Heart Rate/Skinfold Measures/
Cardiorespiratory Measures/Cardiovascular Measures/1963 (descriptor terms)

Coyne, Lawrence L. The Relationship of Maximal Oxygen Intake to Body Composition and Total Body Weight in Active Males. Unpublished thesis, Univ. of Alta., 1963.

N.B. These ten terms agreeing with the thesaurus best describe the content. The year or date closest to publication may be tagged to all documents.

4. Swimming/Teaching Methods/Practice/Breaststroke/Crawl Stroke/Men/
Mental Practice/1963 (descriptor terms)

Clayton, Robert D. The Efficacy of the Land Drill, Implicit Rehearsal, and Water Practice Methods in Teaching the Breast Stroke and Crawl Stroke to College Men. Unpublished doctoral diss., Univ. of Oregon, 1963.

5. Physical Education/Professional Preparation/Evaluation/Undergraduate
Program/Canada/Men/1957 (descriptor terms)

Errington, Joseph. An Evaluation of Undergraduate Professional Preparation in Physical Education for Men in Canada. Unpublished doctoral diss., Univ. of Indiana, 1957.

The following is one illustration of the use of the thesaurus and the descriptor terms to search the information system for documents written on physical education teacher training in Canada, with specific reference to the evaluation of student teaching at the undergraduate level.

And Physical Education
Or Professional Preparation
Or Undergraduate Programs
And Student Teaching
And Evaluation
And Canada
Not Graduate Programs

This search profile will output documents which satisfy all of the 'AND' parameters i.e. documents tagged with Canada, Evaluation, Student Teaching, and Physical Education or Professional Preparation or Undergraduate. It will not output documents indexed "graduate programs" in reference to professional preparations.

SECTION II

Thesaurus Rules and Conventions

Terms

The description of documents (indexing) for information storage and retrieval requires the use of two types: a) those that describe the information contained in the document, and b) bibliographic terms - terms that describe the document itself (e.g. author). Bibliographic terms such as authors and corporate authors, will not be included in the thesaurus.

The rules that were followed in constructing the thesaurus are of three types: (1) fundamental term rules, (2) cross reference rules, (3) the alphabetization rule.

Term Selection

In general, utility of terms can be estimated by considering (a) the relative frequency of appearance among the various contributing vocabularies, (b) the relative frequency of use within an operating system, (c) relationship to descriptors which have been selected previously, (d) scientific or technical preciseness and acceptability. These factors are very much interdependent, and must be considered together in the selection of the descriptors.

Noun Form: In keeping with established practice, noun forms are used wherever possible: classification rather than classify; jumping (gerund) rather than jump. In a limited number of instances, needed retrieval concepts can be represented only by adjectives or equivalent expressions.

Singular-Plural: In choosing between singular and plural noun forms, the precedent established by major indexing and subject cataloging operations are followed. Generally a useful rule of thumb may be applied as follows: use the plural form when the proposed term is a count noun, that is, a noun which may be used to answer the question "how many"; use the singular form for mass nouns, those that express "how much". Common usage should be followed for term types not covered in the above general rule. Where the plural form of the word represents a distinctly different concept from that of the singular both forms may be required.

Direct Entry: Descriptors consisting of two or more words are listed in their natural order: eye movements rather than movements, eye.

Term Definition: Terms that have more than one accepted meaning, that are intended to be used in a somewhat different way than ordinarily defined, or for which distinctions from other terms must be drawn, should be accompanied by an explanation.

(a) Modifying terms may be used to preface a given term, as in accident liability to make the meaning of liability more specific.

(b) A parenthetical qualifying expression may be appended to a term to clarify meaning, e.g. mechanical analysis (of movement).

(c) When a qualifying expression cannot adequately convey the intended meaning, a short explanation called a scope note accompanies the term. Precise dictionary definitions are not attempted. The scope note merely indicates the way in which the descriptor should be used. It is not a part of the descriptor, but follows on a succeeding line, as:

adapted programs

(related to remedial measures
or programs)

Synonyms - Near Synonyms: When two or more terms are true synonyms, one term is selected as the descriptor, the other(s) entered possibly as a cross reference. It is both practical and desirable to consider terms having certain special relationships to be synonyms for indexing and retrieval purposes, e.g. cold, hot, temperature. The preferred term is entered as a descriptor, the other(s) as a cross reference. Terms representing concepts that overlap significantly may be treated as near synonyms, for example: eye movements and vision, or laws and legislation.

Punctuation: Punctuation marks in descriptors are restricted. Parentheses are used to enclosed qualifying expressions which are included in descriptors to prevent ambiguity. Hyphens are used only in terms whose intended meaning would be altered by omission of the hyphen.

Abbreviated Forms: In general, abbreviated terms are avoided as descriptors, since their understanding may not be universal, their meaning may depend on context, or their recognition may be dependent on capitalization and periods, which are constraints in computer operations. Abbreviated terms are considered when meanings are well established and when significant gains in convenience can be demonstrated, e.g. YMCA or CAHPER.

Combined Terms: The use of specific, i.e. precombined, terms to represent concepts that can be represented adequately by using individual terms in combination, can needlessly increase the size and complexity of the indexing vocabulary. On the other hand improper use of term combination often leads to inefficient retrieval.

Cross References

Relationships among terms are shown by cross references, which aid users in selecting descriptors from the thesaurus. The types of cross references used are: USE, USED FOR, NARROWER TERMS, BROADER TERMS, and RELATED TERMS, (See Figure 1).

USE References: The USE reference is intended to lead users of the thesaurus to appropriate descriptors and is employed to refer from a term that is not an authorized descriptor to the term which has been chosen as the descriptor.

USED FOR: The USED FOR reference (UF) is the mandatory reciprocal of the USE reference and accompanies the descriptor to which the USE reference refers.

NARROWER TERMS: The NARROWER TERMS reference (NT) is the reciprocal of the BROADER TERM reference, and is employed to refer from a term symbolizing a concept class to all terms symbolizing concepts that are members of that class.

BROADER TERM: The BROADER TERM reference (BT) is employed to refer from representing a member of a class (or classes) of concepts in any term(s) in the thesaurus representing that class or classes.

RELATED TERMS: The RELATED TERMS reference (RT) is used to refer to and from descriptors that bear a non-structured relationship to each other. In general, any two descriptors are cross referenced RT if it is believed that the user, when examining one descriptor, might want to be reminded of the existence of the other.

Alphabetization

Alphabetize descriptors letter-by-letter, according to the following sequence: (Alphameric Characters in EBCDIC Code for IBM 360)

- (1) Blank ç . (& ! \$ *) ; - , % ? : # @ ' = "
- (2) A.....Z
- (3) 0 1 2 3 4 5 6 7 8 9

N.B. A blank space must be included in the alphabetizing of words. (example: SPRINT START precedes SPRINTING.)

SECTION III

Alphabetic Section

The authorized description terms of this thesaurus follow in this section. Appendix "A" of this section includes the authorized terms for dating historical and comparative information and/or the year of publication of the study.

The following note applies to the terms: Education, Health Education, History, Physical Education, Physiology, Psychology, and Recreation.

* These general terms should only be used if they modify or add meaning to the description of information. They need not be used to classify the contents of a document.

Each authorized descriptor term is assigned a term code number which is useful in manual or computer manipulations.

THESAURUS FOR HEALTH, PHYSICAL

EDUCATION AND RECREATION

AAHPER	(1)	ACADEMIC	(6)
(American Association for Health, Physical Education and Recreation)		NT Academic Ability	
BT Professional Associations		Academic Achievement	
RT Teacher Associations		Academic Education	
		Academic Standards	
		RT Grading	
AAU OF C	(2)	Intelligence	
(Amateur Athletic Union of Canada)			
BT Sports Governing Bodies		ACADEMIC ABILITY	(7)
		BT Ability	
		RT Intelligence	
Abdominal Muscles			
USE Abdomen		ACADEMIC ACHIEVEMENT	(8)
		BT Achievement	
ABDOMEN	(3)	RT Aptitude	
UF Abdominal Muscles		Grading	
Waistline		Intelligence	
BT Human Body			
RT Muscles		ACADEMIC EDUCATION	(9)
		(academic subjects)	
ABILITY	(4)	BT Academic	
NT Academic Ability			
Motor Ability		ACADEMIC STANDARDS	(10)
RT Ability Grouping		BT Academic	
Gifted		RT Accreditation	
Slow Learners		Admission	
ABILITY GROUPING	(5)	ACCIDENT CAUSES	(11)
(for teaching and competition)		BT Accidents	
BT Classification		RT Injuries	
RT Ability		Safety	
Gifted			
Individual Differences		ACCIDENT FREQUENCY	(12)
Motor Ability		BT Accidents	
Poor Achievers		RT Injuries	
		Safety	

ACCIDENT INSURANCE	(13)	ACCREDITATION	(18)
UF Insurance		(of institutions)	
BT Accidents		RT Academic Standards	
RT Injuries		Curriculum	
		Professional Preparation	
ACCIDENT LIABILITY	(14)	Schools	
UF Liability		Teacher Certification	
BT Accidents		Universities	
RT Court Cases			
Injuries		ACCURACY	(19)
Safety		BT Motor Performance	
Waivres		RT Motor Skills	
ACCIDENT PREVENTION	(15)	ACHIEVEMENT (performance)(20)	
BT Accident		NT Academic Achievement	
RT Safety		Achievement Tests	
		Gifted	
Accident Prone		Motor Performance	
USE Accidents		Poor Achievers	
ACCIDENT REPORTING	(16)	ACHIEVEMENT TESTS (Scales)(21)	
BT Accidents		BT Achievement	
RT Injuries			
		Activities	
ACCIDENTS	(17)	USE Games	
(relating to participation in		Pastimes	
athletic activities)		Social Activities	
UF Accident Prone		Sports	
Drowning			
NT Accident Causes		ACTIVITY UNITS	(22)
Accident Frequency		(units of study and activity)	
Accident Insurance		RT Curriculum	
Accident Liability			
Accident Prevention		ADAPTED PROGRAMS	(23)
Accident Reporting		(related to remedial measures	
BT Safety		or programs)	
RT Fatalities		UF Remedial Programs	
First Aid		NT Correctives	
Injuries		BT Physical Education	
Waivres		Physical Therapy	

BT Programs	ADMINISTRATORS	(27)
RT Handicapped	UF Management	
Emotionally Handicapped	NT Athletic Directors	
Mentally Handicapped	Chief Administrators	
Physically Handicapped	Consultants	
Posture	Department Chairmen	
	Health Educators	
Adipose Tissue	Physical Educators	
USE Fat	Recreation Professionals	
	BT Administration	
ADJUSTMENT		(24)
NT Emotional Adjustment	ADMISSION (to an institution)	(28)
Personality Adjustment	RT Academic Standards	
Social Adjustment		
RT Guidance Counselling	Adolescents	
	USE Secondary	
ADMINISTRATION		(25)
NT Administrators	ADULT EDUCATION	(29)
Budget-Finace	BT Education	
Personnel		
Planning	ADULTS	(30)
Supervision	NT Middle Age	
BT Health Education	Senior Citizens	
Physical Education	Young Adults	
Recreation	BT Age	
RT Boards of Education	RT Children	
Computer Programs	AFRICA	(561)
Government		
Human Relations	AGE	(31)
Inservice Training	(chronological age)	
Job Analysis	NT Adults	
Policies	Children	
Problems	Elementary	
Program	Infants	
Public Relations	Middle Age	
	Preschool	
ADMINISTRATOR ATTITUDES	Primary	
BT Attitudes	Secondary	
	Senior Citizens	
	Young Adults	

BT	Maturity		AMATEUR SPORTS	(38)
RT	Post Secondary		BT	Amateurism Sports
	Skeletal Age		RT	Professional Sports
	Students			Professionalism
				Sports Governing Bodies
AGILITY		(32)	AMATEURISM	(665)
BT	Fitness			(code and interpretation)
	Motor Performance		NT	Amateur Sports
RT	Coordination		RT	Professional Sports
	Flexibility			Professionalism
	Speed			Sports Governing Bodies
AIMS-OBJECTIVES		(33)	ANATOMY	(39)
UF	Objectives		RT	Bones
	Values in Physical Education			Human Body
BT	Philosophy			Muscles
RT	Aspiration Level			Physiology
	Attitudes			
	Fitness		ANCIENT CIVILIZATIONS	(40)
	Knowledge		NT	Asia Minor
	Motor Skills			Egyptian
	Social Adjustment			Far East
				Greek
ALBERTA		(34)		Near East
BT	Canada			Roman
			BT	History
ALCHOLOLISM		(35)	RT	Primitive Societies
BT	Health Education			
RT	Drug Addiction		ANIMAL EXPERIMENTS	(41)
	Smoking		RT	Physiology
ALTITUDE		(36)	ANKLE	(42)
RT	Oxygen		BT	Human Body
				Joints
AMA		(37)	RT	Ligaments
	(American Medical Association)		ANTARCTICA	(659)

ANTHROPOLOGY	(43)	ARCHITECTURE	(50)
RT Archeology		UF Building Design	
History		RT Construction	
Sociology		Facilities	
		Planning	
ANTHROPOMETRIC MEASURES	(44)		
(girth measurements, etc.)		ARM	(51)
NT Height		NT Hand	
Weight		BT Human Body	
BT Somatotyping			
RT Body Build		ART FORMS (559)	
		(sculpture, paintings)	
ANXIETY (worry)	(45)		
BT Emotional Measures		ARTIFICIAL RESPIRATION	(52)
RT Motivation		BT First Aid	
Relaxation			
Stress		ASIA (636)	
Apparatus			
USE Equipment		ASIA MINOR (ancient)	(53)
Gymnastics		BT Ancient Civilizations	
APTITUDE	(46)	ASPIRATION LEVEL (ambition)	(54)
RT Academic Achievement		UF Level of Aspiration	
Motor Ability		Self Concept	
Motor Educability		RT Aims-Objectives	
Motor Performance		Motivation	
		Persistence	
AQUATICS	(47)	ATHLETES (trained)	(55)
NT Diving		RT Gifted	
Swimming		Non athletes (untrained)	
Synchronised Swimming		Participation	
		Sedentary Individuals	
ARCHAEOLOGY	(48)		
RT Anthropology		ATHLETIC DIRECTORS	(56)
History		BT Administrators	
ARCHERY	(49)	ATHLETICS	(57)
BT Sports		(all athletic activity)	
		NT Intercollegiate Athletics	

NT Interscholastic Athletics	AWARDS	(61)
Mens Athletics	RT Intercollegiate Athletics	
Womens Athletics	Interscholastic Athletics	
RT Participation	Intramurals	
Attendance	BACK	(62)
USE Participation	BT Human Body	
ATTENTION (660)	BACKSTROKE	(63)
RT Behavior	BT Swimming	
Learning		
Motivation	BADMINTON	(64)
Motor Learning	BT Sports	
Perception		
ATTITUDES (58)	BALANCE	(65)
NT Administrator Attitudes	UF Equilibrium	
Parent Attitudes	BT Perceptual Motor Skills	
Student Attitudes	RT Motor Skills	
Teacher Attitudes	BALLET	(66)
RT Aims-Objectives	BT Dance	
Behavior		
Personality	BASEBALL	(67)
Interests	UF Little League	
Public Opinion	BT Sports	
Testing and Measurement	RT Softball	
	Throwing (pitching)	
Audio Visual Aids	Basic Skills	
USE Instructional Materials	USE Perceptual Motor Skills	
AUDIO EQUIPMENT (59)	BASKETBALL	(68)
BT Equipment	BT Sports	
Instructional Materials		
AUSTRALIA (60)	BEAM (gymnastics)	(69)
BT Countries	BT Gymnastics	
Authors	BEHAVIOR	(70)
See Separate Author List	NT Misbehavior	

BT Psychology	NT Lactic Acid
RT Attention	Ph Level
Attitudes	RBC Count
Delinquents	BT Cardiovascular Measures
Discipline	RT Biochemical Analysis
Growth - Development	Blood Pressure
Motivation	Heart Pressure
	Heart Rate
	Pulse Rate
	Temperature
BICYCLE ERGOMETER (71)	
RT Cardiorespiratory Measures	
Cardiovascular Measures	
Fitness	BLOOD PRESSURE (76)
Testing and Measurement	BT Cardiovascular Measures
Work Capacity	RT Blood Measures
	Heart Rate
	Pulse Rate
BIOCHEMICAL ANALYSIS (72)	
RT Blood Measures	
Physiology	BOARDS OF EDUCATION (77)
	(of schools, colleges, etc.)
BIOGRAPHIES (73)	UF School Boards
(of men and women in the field)	RT Administration
UF Leaders	
RT Health Education	BODY BUILD (78)
History	UF Physical Development
Philosophy	Physique
Physical Education	NT Human Body
Recreation Professionals	BT Somatotyping
	RT Anthropometric Measures
	Body Density
BLIND (74)	Fat
BT Vision	Weight
RT Physically Handicapped	Weight Training
Blood Circulation	BODY DENSITY (composition) (79)
USE Cardiovascular measures	UF Densiometry
	RT Body Build
BLOOD MEASURES (incl. composition) (75)	Fat
NT Cholesterol Level	Skin Fold Measures
Hemoglobin Level	Somatotyping

RT Weight		BUDGET-FINANCE	(89)
Weight Reduction		BT Administration	
BODY IMAGE (558)		RT Financial Support	
BT Perceptual Motor Skills		Government	
Body Mechanics		Building	
USE Kinesiology		USE Construction	
Body Weight		Building Design	
USE Weight		USE Archetecture	
BONES	(80)	BUTTERFLY STROKE	(90)
RT Anatomy		BT Swimming	
Muscles		BYZANTINE (period)	(91)
BOOKS (list of)	(81)	BT History	
BOWLING	(82)	CABLE TENSION STRENGTH	(92)
BT Sports		RT Strength	
BOXING	(83)	CAHPER	(93)
BT Sports		(Canadian Association for	
BOYS (ages 1 to 19)	(84)	Health, Physical Education,	
BT Children		and Recreation)	
RT Men		BT Professional Associates	
Brochial Pulse		Calisthenics	
USE Pulse Rate		USE Exercise	
BRAIN	(86)	CALORIC CONSUMPTION	(94)
BT Human Body		RT Metabolism	
Electroencephalograph		Nutrition	
BREASTROKE	(87)	Oxygen Uptake	
BT Swimming		Weight	
BRITISH COLUMBIA	(88)	Weight Reduction	
BT Canada		CAMPING	(95)
		BT Outdoor Education	

Camp Leadership

USE Leadership

CANADA (96)

NT Alberta

British Columbia

Manitoba

New Brunswick

Newfoundland

North West Territories

Nova Scotia

Ontario

Prince Edward Island

Quebec

Saskatchewan

RT Canadian Indians

Government

CANADIAN INDIANS (97)

RT Canada

CANOEING (98)

(pleasure, not competition)

RT Paddling (competition)

Rowing

CARDIAC OUTPUT (99)

BT Cardiovascular Measures

CARDIORESPIRATORY MEASURES(100)

UF Vital Capacity

NT Oxygen Uptake

Respiratory Quotient

Work Capacity

BT Fitness

Respiration

RT Bicycle Engometer

Endurance

Gas Analysis

RT Treadmill

CARDIOVASCULAR MEASURES (101)

UF Blood Circulation

NT Blood Measures

Blood Pressure

Cardiac Output

Electrocardiograph

Heart Rate

Pulse Rate

Work Capacity

BT Fitness

RT Bicycle Engometer

Cholesterol Level

Endurance

Heart

Temperature

Treadmill

CASE STUDIES (102)

RT Human Relations

Research

CAUCASIAN (race) (103)

BT Race

CENTRAL AMERICA (562)

Certification Requirements

USE Teacher Certification

CHAMPIONSHIPS (104)

NT World Championships

RT International Games

Character

USE Personality

CHIEF ADMINISTRATORS (105)

BT Administrators

CHILDBIRTH	(106)	CLASSIFICATION (of	(113)
RT Children		individual, groups	
		and activities)	
		UF Screening	
CHILDREN (ages 1 to 12)	(107)	NT Ability Grouping	
UF Child Study		Games Classification	
NT Boys		Somatotyping	
Girls		RT Evaluation	
BT Age			
RT Adults		CLASSROOM TEACHERS	(638)
Elementary		BT Teachers	
Growth - Development			
Infants		CLASSROOMS	(114)
Primary		BT Facilities	
Child Study			
USE Children		CMA (Canadian Medical	(115)
		Association)	
CHINA (mainland)	(108)	Coaches	
RT Taiwan		USE Coaching	
BT Countries			
		COACHING	(116)
CHOLESTEROL LEVEL	(109)	UF Coaches	
BT Blood measures		RT Players	
RT Cardiovascular Measures		Recruitment	
		Selection	
CHURCH	(110)	Teaching Methods	
BT Religion			
RT Moral Values		COCURRICULAR ACTIVITIES	(117)
		UF Extra Curricular	
CINEMATOGRAPHY	(111)	NT Intercollegiate Athletics	
NT Films		Interscholastic Athletics	
BT Kinesiology		Intramurals	
Mechanical Analysis		BT Program	
CIRCUIT TRAINING	(112)	COEDUCATION	(118)
BT Fitness		RT Curriculum	
Training			
RT Endurance		Cold	
Internal Training		USE Temperature	

Colleges		COMPUTER PROGRAMS	(126)
USE Universities		RT Administration	
College Physical Education		CONCENTRIC STRENGTH	(127)
USE CPEA Association		BT Isotmic Strength	
		Strength	
COMMONWEALTH GAMES	(119)		
BT International Games		Conditioning Program	
		USE Training	
COMMUNICABLE DISEASES	(120)		
BT Diseases		CONSTRUCTION	(128)
RT Public Health		UF Building	
		RT Architecture	
COMMUNICATIONS	(121)	Facilities	
RT Information Retrieval		Maintenance	
Promotion		Planning	
Public Relations			
		CONSULTANTS	(129)
COMMUNITY	(122)	BT Administrators	
RT School Community			
Community School		COORDINATION	(130)
USE School - Community		(general & specific)	
		UF Timing	
COMPARATIVE STUDY	(123)	NT Hand - Eye Coordination	
(study of the comparison		Perceptual Motor Skills	
of current health education,		BT Motor Learning	
physical education, and rec-		Motor Performance	
reation theory in practice		RT Agility	
in different cultures)			
RT History		CORRECTIVES	(131)
		UF Rehabilitation	
COMPETITION	(124)	BT Adapted Programs	
RT Countries		Physical Therapy	
Sports		Physically Handicapped	
COMPREHENSIVE SCHOOLS	(125)	COSTS Budget-Finance	(132)
BT Schools		RT Equipment	
		Facilities	

COUNTRIES (and regions)	(133)	CREATIVE MOVEMENT	(137)
NT Australia		UF Free Movement	
Canada		Movement Education	
China		BT Creativity	
Czechoslovakia		RT Dance	
Denmark		Dramatics	
England		Gymnastics	
Finland		Music	
France		Problem Solving Approach	
Germany		Rhythmics	
Ghana			
Greece		CREATIVITY (650)	
Isreal		NT Creative Movement	
Japan		RT Dance	
Melanesia		CRICKET	(138)
Mexico		BT Sports	
Norway		CROSS COUNTRY RUNNING	(139)
Polynesia		(Harrier)	
Russia		RT Endurance	
Scotland		Running	
Spain		CROSS COUNTRY SKIING	(140)
Sweden		BT Skiing	
Taiwan		Sports	
United Kingdom			
United States		CULTURE (the integral whole	(141)
RT Competition		of a society)	
Government		NT Economic Factors	
COURSE DESCRIPTIONS	(134)	Political Factors	
RT Curriculum		Primitive Societies	
		Social Factors	
COURT CASES	(135)		
RT Accident Liability		CURLING	(142)
Laws		BT Sports	
CPEA (America)	(640)		
UF College Physical Education Assoc.		CURRICULUM (instructional	(143)
		program or courses of	
		study)	
CRAWL STROKE	(136)	NT Dance	
BT Swimming		Elementary	
		Graduate Programs	

NT	Preschool		DECATHLON	(147)
	Secondary		BT	Track & Field
	Undergraduate Programs		RT	Pentathlon
BT	Programs			
RT	Activity Units		DEFENSE	(148)
	Cocurricular Activities		RT	Offense
	Coeducation			
	Course Descriptions		DEHYDRATION	(149)
	Education		RT	Temperature
	Intramurals			Weight Reduction
	Planning			
	Tests		DELINQUENTS (public offenders	(150)
	Time Allotment		all ages)	
			UF	Juvenile Delinquency
			RT	Behavior
CYCLING		(144)		
BT	Sports		Democracy	
			USE	Philosophy
CZECHOSLOVAKIA		(145)		
BT	Countries		DEMONSTRATION PROJECTS	(151)
			(Educational)	
DANCE		(146)	RT	Programs
NT	Ballet			Public Relations
	Folk Dance			
	Modern Dance		DENMARK	(152)
BT	Curriculum		BT	Countries
RT	Creative Movement			
	Creativity		DESCRIPTION OF CHANGES	(641)
	Dramatics		RT	Comparative Analysis
	Music			History
	Rhythmics			Rules
	Social Activities			Theory Development
Dating History Events,			Densiometry	
Comparative Information on			USE	Body Density
Year of Study - See Appendix "A"				
Deaf			DENTAL HEALTH	(153)
USE Hearing			ET	Health Education
			RT	Injuries

DEPARTMENT CHAIRMAN	(154)	DIVING	(160)
BT Administrators		BT Aquatics	
		Sports	
Depth Perception			
USE Perception		DRAMATICS	(161)
		RT Creative Movement	
DESCRIPTION OF CHANGES	(641)	Creativity	
RT History		Dance	
Rules			
Theory Development		Drowning	
		USE Accidents	
Desire			
USE Motivation		DRUG ADDICTION	(162)
		BT Health Education	
DEVELOPMENT	(155)	RT Alcoholism	
NT Growth - Development		Drugs	
DIET	(156)	DRUGS (stimulants, depressants)	(163)
NT Weight Reduction		RT Drug Addiction	
BT Nutrition		Ergogenic Aids	
RT Ergogenic Aids			
Foods		DYNAMOMETERS	(164)
		RT Strength	
DISCIPLINE (individual	(157)	EAST ASIA	(654)
and group)		EAST EUROPE	(658)
RT Behavior		Eccentric Exercise	
Motivation		USE Eccentric Strength	
DISCUS THROW	(158)	ECCENTRIC STRENGTH	(165)
BT Track and Field		UF Eccentric exercise	
		BT Isotonic Strength	
		Strength	
DISEASES	(159)		
NT Communicable Diseases		ECONOMIC FACTORS	(166)
RT Health Education		BT Culture	
Public Health		RT Political Factors	
		Social Factors	
Distance Running		Socio-Economic Status	
USE Cross Country Running		Sociology	
Running			

EDUCATION*(general (167)

education, academic
or technical education)

NT Adult Education
Family Life Education
Health Education
Physical Education
Sex Education
Special Education

RT Curriculum
Learning
Professional Preparation

EGYPTIAN (ancient) (168)

BT Ancient Civilizations

ELBOW (639)

BT Human Body

ELECTRICAL STRESS (169)

BT Stress

ELECTROCARDIOGRAPH (170)

BT Cardiovascular Measures
RT Heart
Heart Rate

ELECTROENCEPHALOGRAPH (171)

RT Brain

ELECTROMYOGRAPHY (172)

RT Muscles

ELECTROGONIOMETERS (173)

UF Goniometer
RT Mechanical Analysis

ELEMENTARY (ages 9 - 12) (174)

(Children program or school)

BT Age
Curriculum
Schools
RT Children
Primary
Students

EMOTIONAL ADJUSTMENT (175)

BT Adjustment
RT Emotionally Handicapped

EMOTIONAL MEASURES (176)

UF Galvanic Skin Response
NT Anxiety
Stress
BT Psychology
RT Endocrinology
Personality Adjustment
Relaxation

EMOTIONALLY HANDICAPPED (177)
(disturbed)

BT Adapted Programs
Handicapped
RT Emotional Adjustment
Mentally Handicapped
Special Education

ENDOCRINOLOGY (178)

BT Physiology
RT Emotional Measures

ENDURANCE (179)

BT Fitness
RT Cardiorespiratory Measures

RT Cardiovascular Measures		RT Purchasing	
Circuit Training		Records	
Muscles		Selection	
		Specifications	
ENERGY COST	(180)	Testing & Measurement	
UF Physiological Cost			
RT Oxygen Uptake		EQUIPMENT CARE	(185)
Oxygen Debt		BT Equipment	
		RT Laboratory Equipment	
ENGLAND	(181)		
BT Countries		Equipment Design	
Great Britain		USE Equipment Testing	
ENVIRONMENTAL FACTORS	(182)	EQUIPMENT STORAGE	(186)
(Community)		BT Equipment	
UF Rural		Facilities	
Urban			
		EQUIPMENT TESTING	(563)
EQUESTRIAN	(183)	BT Equipment	
UF Horse Riding		RT Laboratory Equipment	
BT Sports		Protective Equipment	
		Testing and Measurement	
Equilibrium			
USE Balance		ERGOGENIC AIDS	(187)
		RT Diet	
EQUIPMENT	(184)	Drugs	
UF Apparatus		Food	
NT Audio Equipment		Metabolism	
Equipment Care		Oxygen	
Equipment Storage			
Equipment Testing		ETHICS	(188)
Laboratory Equipment		RT Moral Values	
Protective Equipment		Religion	
Visual Equipment		Sportsmanship	
RT Costs			
Facilities		EUROPE	(564)
Maintenance			

EVALUATION (189)

(of individuals, groups
and programs)
NT Grading
Report Cards
Testing and Measurement

RT ClaSsification
Programs
Surveys
Teacher Certification

EXERCISES (190)

UF Calisthenics
RT Gymnastics
Weight Reduction
Weight Training

Exhaustion
USE Fatigue

Extracurricular (activities)
USE Cocurricular Activities

Eye Hand Coordination
USE Hand Eye Coordination

Eye Movements
USE Vision

FACILITIES (191)

(non moveable property)

NT Classrooms
Equipment Storage
Gymnasia
Laboratories
Laundries
Locker Rooms
Offices

NT Parks
Playgrounds
Playing Fields
Recreation Centres
Rinks (Ice)
Swimming Pools
Tennis Courts
Track
Training Room

RT Architecture
Construction
Costs
Equipment
Maintenance
Planning

FACTOR ANALYSIS (192)

BT Statistical Analysis
Statistics

Faculty
USE University Faculty

FAMILY LIFE EDUCATION (193)

BT Education
Health Education
RT Sex Education

FAR EAST (ancient) (194)

BT Ancient Civilizations

FAT (195)

UF Adipose Tissue
RT Body Build
Body Density
Obesity
Skin Fold Measures
Weight
Weight Reduction

FATALITIES (663)		BT Cinematography	
RT Accidents		Instructional Materials	
Injuries		RT Photographs	
		Visual Equipment	
FATIGUE (196)			
(phsiological and		FINANCIAL SUPPORT (204)	
Psychological)		RT Budget Finance	
UF Exhaustion		Government	
RT Stress			
FEDERAL GOVERNMENT (197)		FINLAND (360)	
BT Government		BT Countries	
RT Provincial Government			
FEEDBACK (198)		FIRST AID (205)	
UF Knowledge of Results		NT Artificial Respiration	
RT Kincsthesi		BT Health Education	
Learning		RT Accidents	
Reinforcement		Safety	
FEET (199)		FISHING (206)	
BT Human Body		RT Hunting	
		BT Sports	
FENCING (200)		FITNESS (physical fitness(207)	
BT Sports		in widest understanding)	
		UF Motor Fitness	
FIELD HOCKEY (201)		Physical Fitness	
BT Sports		NT Agility	
		Cardiovascular Measures	
FIGURE SKATING (202)		Cardiorespiratory Measures	
BT Ice Skating		Endurance	
Sports		Flexibility	
RT Roller Skating		Strength	
FILMS (use of motion picture) (203)		RT Aims-Objectives	
		Motor Ability	
		Motor Performance	
		Physical Health	

RT Speed		FRANCE	(214)
Training		BT Countries	
Treadmill			
Warm Up		Free Movement	
Work Capacity		USE Creative Movement	
FLEXIBILITY	(208)	Fundamental Skills	
BT Fitness		USE Perceptual Motor Skills	
Motor Performance			
RT Agility		Galvanic Skin Response	
		USE Emotional Measures	
FLOOR EXERCISE	(209)		
BT Gymnastics		GAMES (of law organization)	(215)
		UF Activities	
FOLK DANCE	(210)	RT Games Classification	
BT Dance		Pastimes	
RT Countries		Players	
Modern Dance		Recreation	
Music		Sports	
Rhythmics			
		GAMES CLASSIFICATION	(216)
FOODS (211)		BT Classification	
RT Diet		RT Games	
Ergogenic Aids			
		GAS ANALYSIS	(217)
FOOTBALL	(212)	RT Cardiorespiratory Measures	
BT Sports			
RT Kicking		GERMANY	(218)
Throwing		BT Countries	
FORCE (analysis of movement) (213)		GHANA	(219)
RT Impulse		BT Countries	
Kinesiology			
Mechanical Analysis		GIFTED (atypical)	(220)
Stress		RT Ability	
Time		Ability Grouping	
		Achievement	

RT Athletes		RT Professional Preparation	
Poor Achievers		Students	
GIRLS (ages 1 - 19)	(221)	GREECE	(227)
BT Children		BT Countries	
RT Women			
Goals		GREEK (Ancient)	(228)
USE Aims Objectives		BT Ancient Civilization	
		Grip Strength	
GOLF (222)		USE Strength	
BT Sports			
		Gross Movement	
Goniometer		USE Movement	
USE Electrogoniometer			
GOVERNMENT (administrative (223)		GROUP DYNAMICS	(229)
body)		RT Human Relations	
NT Federal Government		Leadership	
Provincial Government		Social Activities	
RT Administration			
Canada		Growth	
Countries		USE Growth-Development	
Financial Support			
Political Factors		GROWTH - DEVELOPMENT	(230)
Sports Governing Bodies		UF Growth	
		Physical Development	
GRADING (for reporting (224)		RT Behavior	
procedures)		Children	
BT Evaluation		Maturity	
RT Academic		Nutrition	
Academic Achievement			
Report Cards		GUIDANCE COUNSELING	(231)
Testing and Measurement		RT Adjustment	
GRADUATE PROGRAMS (225)		GYMNASIA	(232)
BT Curriculum		BT Facilities	

GYMNASTICS	(233)	Health	
UF Apparatus		USE Health Education	
NT Beam		Hygiene	
Floor Exercise			
Horizontal Bar		HEALTH EDUCATION*	(241)
Parallel Bars		UF Health	
Rings		School Health	
Side Horse		NT Alcoholism	
Trampoline		Dental Health	
Uneven Parallels		Drug Addiction	
Vaulting		Family Life Education	
RT Creative Movement		First Aid	
Exercise		Mental Health	
Tumbling		Nutrition	
		Occupational Health	
HAMMER THROW	(234)	Programs	
BT Human Body		Sanitation	
HAND	(235)	Sex Education	
BT Human Body		Smoking	
HAND-EYE COORDINATION	(237)	BT Education	
UF Eye-Hand Coordination		RT Diseases	
BT Coordination		Health Educators	
Perceptual Motor Skills		Health Services	
HANDBALL (all styles of game)	(236)	Human Body	
BT Sports		Hygiene	
		Physical Health	
HANDICAPPED	(238)	Physical Education	
NT Emotionally Handicapped		Public Health	
Mentally Handicapped		Venereal Diseases	
Physically Handicapped			
RT Adapted Programs		HEALTH EDUCATORS	(242)
Slow Learners		(Administrators, Researchers,	
		Teachers)	
HANDICRAFTS	(239)	UF Leaders	
RT Hobbies		NT Teachers	
HEAD	(240)		
BT Human Body			

RT Biographies	HEMOGLOBIN LEVEL	(248)
Health Education	BT Blood Measures	
Personnel		
HEALTH SERVICES (of school and community)	HIGH JUMP	(249)
UF Nurse	BT Track and Field	
School Nurse	High School	
BT Public Health	USE Secondary	
RT Health Education	HIP	(250)
Records	BT Human Body	
HEARING	Historical	
UF Deaf	USE History	
BT Perception		
RT Physically Handicapped	HISTORY* (See also Appendix A)	(251)
HEART	UF Historical	
BT Human Body	NT Ancient Civilizations	
RT Cardiovascular Measures	RT Anthropology	
Electrocardiograph	Archaeology	
Heart Rate	Biographies	
	Byzantine	
	Comparative Study	
HEART RATE	Description of Changes	
BT Cardiovascular Measures	Medieval	
RT Blood Measures	Modern	
Blood Pressure	Preliterate	
Electrocardiograph	Renaissance	
Heart		
Pulse Rate	HOBBIES	(252)
	RT Handicrafts	
Heat	Pastimes	
USE Temperature	Recreation	
HEIGHT (body measurement)	Hockey	
BT Anthropometric Measures	USE Ice Hockey	
RT Somatotyping	Field Hockey	
Weight		

Hop, Step, and Jump

USE Triple Jump

HORIZONTAL BAR

(253)

BT Gymnastics

Horse Riding

USE Equestrian

BT Body Build

RT Anatomy

Handicapped

Health Education

Physiology

Protective Equipment

Strength

Weight

HORSE RACING

(254)

BT Sports

Hot

USE Temperature

HUMAN RELATIONS

(256)

RT Administration

Case Studies

Group Dynamics

Internation Relations

Personnel

HUMAN BODY

(255)

NT Abdomen

Ankle

Arm

Back

Brain

Elbow

Feet

Hand

Head

Heart

Hip

Internal Organs

Joint

knee

Leg

Ligaments

Muscles

Neck

Nervous System

Shoulder

Wrist

HUNTING

(257)

BT Sports

RT Fishing

HURDLES

(258)

BT Track and Field

HYGIENE (science of health) (259)

UF Health

RT Health Education

Physical Health

ICE HOCKEY

(260)

UF Hockey

BT Sports

ICE SKATING

(261)

NT Figure Skating

Speed Skating

ICHPER (262)
UF International Council of
Health, Physical Education
and Recreation
BT Professional Associations

IMPULSE (force-time) (263)
RT Force
Kinesiology
Mechanical Analysis
Time
Velocity

INDEXES (journals, films (264)
microcards)
RT Information Retrieval
Libraries

INDIVIDUAL DIFFERENCES (265)
RT Ability Grouping

INDO-PAKISTAN (653)

INDUSTRY (266)
UF Workers

INFANTS (birth to 12 mos.) (637)
BT Age
RT Children

INFORMATION RETRIEVAL (267)

INJURIES (268)
NT Treatment of injuries
RT Accident Causes
Accident Frequency
Accident Insurance
Accident Liability
Accident Prevention
Accident Reporting
Accidents

RT Dental Health
Fatalities
First Aid
Safety

INSERVICE TRAINING (269)
(training of personnel)
UF Coaches Clinics
RT Administration
Personnel
Teaching Methods

INSTRUCTIONAL MATERIALS (270)
UF Audio Visual Aids
NT Audio Equipment
Films
Photographs
Visual Equipment
Television

Instructional Program
USE Curriculum

Insurance
USE Accident Insurance

INTELLIGENCE (271)
RT Academic
Academic Ability
Academic Achievement

INTERCOLLEGIATE ATHLETICS (272)
BT Athletics
Cocurricular Activities
RT Awards
Interscholastic Athletics
Universities

INTERESTS	(273)	INTRAMURALS	(279)
RT Attitudes		BT Cocurricular Activities	
Recreation		Programs	
Sports Preferences		RT Awards	
		Curriculum	
INTERNAL ORGANS (of body)	(274)	Inventory	
NT Brain		USE Records	
Heart			
BT Human Body			
INTERNATIONAL RELATIONS	(275)	ISOMETRIC STRENGTH	(280)
RT Human Relations		BT Strength	
International Games			
INTERNATIONAL GAMES	(276)	ISOTONIC STRENGTH	(281)
NT Commonwealth Games		NT Concentric Strength	
Maccabian Games		Eccentric Strength	
Olympic Games		BT Strength	
Pan American Games			
World Championships		ISRAEL	(282)
RT Championships		BT Countries	
International Relations			
International Council of		JAPAN	(283)
Health, Physical Education		BT Countries	
and Recreation			
USE ICHPER		JAVELIN THROW	(284)
INTERSCHOLASTIC ATHLETICS	(277)	BT Track and Field	
BT Athletics			
Cocurricular Activities		JOB ANALYSIS	(285)
Programs		UF Work Load	
RT Awards		BT Administration	
Intercollegiate Athletics		RT Personnel	
		Salary	
INTERVAL TRAINING	(278)	JOINTS	(286)
BT Training		NT Ankle	
RT Circuit Training		Knee	
		Wrist	
		BT Human Body	
		RT Ligaments	

JUDO	(287)	Knowledge of Results
BT Sports		USE Feedback
JUMPING (including jumping(288) rope)		LABORATORIES (294)
RT Skiing		NT Laboratory Equipment
Track and Field		Laboratory Technique
		BT Facilities
Juvenile Delinquency		LABORATORY EQUIPMENT (295)
USE Delinquency		NT Telemetric (Equipment)
		BT Equipment
KICKING	(289)	RT Equipment Care
RT Football		Equipment Testing
Soccer		
KINESIOLOGY	(290)	LABORATORY TECHNIQUE (296)
UF Body Mechanics		BT Laboratories
Cinematographical Analysis		
Mechanical Analysis		LACROSSE (297)
RT Force		BT Sports
Impulse		
Velocity		LACTIC ACID (298)
		BT Blood Measures
		RT Oxygen
		ph Level
KINESTHESIS	(291)	
UF Muscular Sense		LAUNDRIES (299)
Proprioceptive Sense		BT Facilities
BT Perception		
RT Feedback		LAWS (300)
		UF Legislation
KNEE (292)	(292)	RT Court Cases
BT Human Body		Policies
Joints		Sociology
RT Legaments		
KNOWLEDGE (as measured (293) by testing)		Leaders (in Profession)
RT Aims-Objectives		USE Biographies
Testing and Measurement		Health Educators
		Philosophy

USE Physical Educators Recreation Professionals		LIGAMENTS	(306)
		BT Human Body	
		RT Ankle	
LEADERSHIP (training of and program for)	(301)	Joints	
		Knee	
UF Camp Leadership			
Recreation Leaders		Little League	
RT Group Dynamics		USE Baseball	
LEARNING	(302)	LOCKER ROOMS	(307)
NT Motor Learning		BT Facilities	
Verbal Learning			
RT Attention			
Education			
Feedback			
Memory		LONG JUMP	(308)
Practice		BT Track and Field	
Reinforcement			
Reminiscence		MACCABIAN GAMES	(309)
Specificity		BT International Games	
LEG	(303)	MAINTENANCE	(310)
BT Human Body		RT Construction	
		Equipment	
Legislation		Facilities	
USE Laws			
		Management	
LEISURE	(304)	USE Administrators	
RT Recreation			
		MANITOBA	(311)
Level of Aspiration		BT Canada	
USE Aspiration Level			
		MATURITY	(312)
Liability		NT Age	
USE Accident Liability		RT Growth-Development	
		Skeletal Age	
LIBRARIES	(305)		
RT Information Retrieval			

Measurement		RT Emotionally Handicapped
USE Testing and Measurement		Mentally Handicapped
		Mentally Ill
MECHANICAL ANALYSIS	(313)	Physical health
(of movement)		
UF Skill Analysis		MENTAL PRACTICE (635)
NT Cinematography		BT Practice
BT Kinesiology		
RT Electrogoniometers		MENTALLY HANDICAPPED (321)
Force		UF Mentally Retarded
Impulse		BT Handicapped
Motor Skills		RT Adapted Programs
Velocity		Emotionally Handicapped
		Mental Health
MEDIEVAL (period)	(314)	Mentally Ill
BT History		Physically Handicapped
		Special Education
MELANESIA	(315)	
BT Countries		MENTALLY ILL (322)
		(non-permanent illness)
MEMORY	(316)	BT Psychology
UF Retention		RT Mental Health
RT Learning		Mentally Handicapped
MEN	(317)	Mentally Retarded
RT Boys		USE Mentally Handicapped
MENS ATHLETICS	(318)	METABOLISM (323)
BT Athletics		RT Caloric Consumption
		Ergogenic Aids
		Nutrition
MENSTRUATION	(319)	Oxygen Uptake
RT Sex Education		
Women's Athletics		Methods
		USE Teaching Methods
MENTAL HEALTH	(320)	
BT Health Education		

MEXICO	(324)	RT	Discipline	
BT Countries			Stress	
MIDDLE AGE (ages 40-65)	(325)	MOTOR	ABILITY	(331)
BT Adults			(Motor aptitude)	
Age		UF	Ability	
			Motor Capacity	
MISBEHAVIOR	(326)		Physical Ability	
BT Behavior		RT	Ability Grouping	
			Aptitude	
MODERN (period)	(327)		Fitness	
BT History			Rhythmic Ability	
			Transfer	
MODERN DANCE	(328)			
BT Dance			Motor Capacity	
RT Creative Movement			USE Motor Ability	
Folk Dance				
Music		MOTOR	EDUCABILITY	(332)
Rhythmics		RT	Aptitude	
			Transfer	
MORAL VALUES	(329)			
UF Values in Physical			Motor Fitness	
Education			USE Fitness	
RT Church				
Ethics		MOTOR	LEARNING	(333)
Personality		UF	Skill Learning	
Religion		NT	Coordination	
Sportsmanship		BT	Learning	
			Psychology	
MOTIVATION	(330)	RT	Attention	
UF Desire			Motor Skills	
Stateness			Perception	
BT Psychology			Perceptual Motor Skills	
RT Aspiration Level			Practice Reinforcements	
Attention			Specificity	
Anxiety			Teaching Methods	
Behavior			Transfer	
			Verbal Learning	

MOTOR PERFORMANCE	(334)	Movement Education	
NT Agility		USE Creative Movement	
Accuracy			
Coordination		MOVEMENT TIME	(338)
Flexibility		BT Motor Performance	
Movement Time		RT Reaction Time	
Reaction Time'		Speed	
Speed			
BT Achievement		MUSCLES	(339)
RT Aptitude		UF Muscle Tone	
Fitness		BT Human Body	
Warm-Up		RT Anatomy	
		Bones	
MOTOR SKILLS	(335)	Electromography	
UF Skills		Endurance	
RT Aims-Objectives			
Accuracy		Muscle Tone	
Balance		USE Muscles	
Defence			
Mechanical Analysis		Muscular Sense	
Motor Learning		USE Kinestheses	
Offense			
Sport		MUSIC (Selections)	(340)
Testing and Measurement		RT Creative Movement	
Transfer		Dance	
		Folk Dance	
MOUNTAINEERING	(336)	Modern Dance	
BT Pastimes		Rhythmics	
RT Orienteering			
Outdoor Education		NEAR EAST (ancient)	(341)
		BT Ancient Civilization	
MOVEMENT	(337)		
UF Gross Movement		NECK	(342)
		BT Human Body	

NEGRO (race)	(343)	NUTRITION	(352)
BT Race		UF Food	
		Vitamins	
NERVOUS SYSTEM	(344)	NT Diet	
NT Human Body		BT Health Education	
		RT Calorie Consumption	
NEW BRUNSWICK	(345)	Ergogenic Aids	
BT Canada		Growth Development	
		Metabolism	
NEWFOUNDLAND	(346)		
BT Canada		OBESITY	(353)
		RT Fat	
NONATHLETES (untrained)	(347)	Weight	
RT Athletes		Weight Reduction	
Participation			
Sedentary Individuals		Objectives	
		USE Aims-Objectives	
NORMATIVE STUDIES	(348)	OCCUPATIONAL HEALTH	(645)
BT Statistical Analysis		BT Health Education	
NORTH AMERICA	(565)	RT Safety	
NORTH WEST TERRITORIES	(349)	OFFENSE	(354)
BT Canada		RT Defense	
		Motor Skill	
NORWAY	(350)		
BT Countries		OFFICIATING	(355)
		RT Rules	
NOVA SCOTIA	(351)		
BT Canada		OFFICES	(356)
		BT Facilities	
Nurse			
USE Health Services			

OLYMPIC GAMES	(357)	PADDLING (Competition)	(365)
(Summer and Winter)		RT Canoeing	
BT International Games		Rowing	
ONTARIO	(358)	PAN AMERICAN GAMES	(366)
BT Canada		BT International Games	
Organization		PARALLEL BARS	(367)
USE Planning		BT Gymnastics	
ORIENTEERING	(359)	PARENT ATTITUDES	(368)
RT Mountaineering		BT Attitude	
Outdoor Education		RT Parent-School Relationship	
OUTDOOR EDUCATION	(361)	PARENT-SCHOOL RELATIONSHIP	(370)
NT Camping		RT Parent Attitudes	
RT Mountaineering		PARENTS	(369)
Recreation		RT Public Relations	
OXYGEN	(362)	PARKS	(371)
RT Altitude		BT Facilities	
Ergogenic Aids		PARTICIPATION	(372)
Lactic Acid		(in athletic programs)	
Oxygen Uptake		UF Attendance	
Oxygen Debt		BT Programs	
OXYGEN DEBT	(363)	RT Athletes	
RT Energy Cost		Monathletes	
Oxygen		Sedentary Individuals	
Oxygen Uptake		Part Method	
OXYGEN UPTAKE (Consumption)	(364)	USE Teaching Methods	
BT Cardiorespiratory Measures		PASTIMES	(373)
RT Energy Cost		UF Activities	
Metabolism		NT Mountaineering	
Oxygen		RT Games	
Oxygen Uptake			

RT Handicrafts
Hobbies
Recreation
Social Activities
Sports

Peer Status
USE Social Adjustment

PENTATHLON (374)
BT Track and Field
RT Decathlon

PERCEPTION (375)
UF Depth Perception
NT Hearing
Kinesthesia
Vision
RT Attention
Motor Learning
Perceptical Motor Skills
Rhythmic Ability

PERCEPTUAL MOTOR SKILLS (376)
(basic skills)
UF Basic Skills
Fundamental Skills
NT Balance
Body Image
Coordination
Hand-Eye Coordination
RT Motor Learning
Perception
Rhythmic Ability
Vision

Performance
USE Motor Performance

PERSISTENCE (560)
RT Aspiration Level

PERSONALITY (377)
UF Character
NT Personality Adjustment
BT Psychology
RT Attitudes
Moral Values

PERSONALITY ADJUSTMENT (378)
BT Personality
Psychology
RT Emotional Measures

PERSONNEL (379)
BT Administration
RT Health Education
Human Relations
Inservice Training
Job Analysis
Physical Education
Recruitment
Recreation Professionals
Teachers
Selection
Supervision

PH LEVEL (381)
BT Blood Measures
RT Lactic Acid

PHILOSOPHY (380)
UF Democracy
Leaders
Values in Physical Education
NT Aims - Objectives
RT Biographies
Research

PHOTOGRAPHS (382)

BT Instructional Materials

RT Films

Visual Equipment

Physical Ability

USE Motor Ability

Physical Development

USE Body Built

Growth Development

Somatotyping

PHYSICAL EDUCATION* (383)

NT Adapted Programs

Athletics

Programs

BT Education

RT Health Education

Physical Therapy

Recreation

PHYSICAL EDUCATORS (384)

(Administrators, Researchers,
and Teachers)

UF Leaders

NT Administrators

Teachers

RT Biographies

Health Educators

Personnel

Recreation Professionals

University Faculty

Physical Fitness

USE Fitness

PHYSICAL HEALTH (634)

RT Fitness

Health Education

Hygiene

Mental Health

PHYSICALLY HANDICAPPED (385)

BT Handicapped

RT Adapted Programs

Blind

Correctives

Hearing

Mentally Handicapped

PHYSICAL THERAPY (386)

NT Adapted Programs

Correctives

RT Treatment of Injuries

Physical Education

Physically Handicapped

PHYSIOLOGY* (387)

NT Endocrinology

RT Anatomy

Animal Experiments

Biochemical Analysis

Human Body

Physiological Cost

USE Energy Cost

Physique

USE Body Build Somatotyping

PLANNING (388)

UF Organization

BT Administration

RT Architecture

Construction

Curriculum

Facilities

PLAY (389)

RT Playgrounds

Theory Development

PLAYERS	(390)	Power
RT Coaching		USE Strength
Games		
Sports		PRACTICE (396)
		NT Mental Practice
PLAYING FIELDS (sports)	(391)	RT Learning
BT Facilities		Motor Learning
RT Sports		
		Practice Teaching
POLICIES	(392)	USE Student Teaching
RT Administration		
Laws		PRELITERATE (age or Period) (397)
Problems		BT History
		RT Primitive Societies
POLITICAL FACTORS	(393)	
BT Culture		PRESCHOOL (Children, program) (398)
RT Economic Factors		(-ages 1 to 4)
Government		BT Age
Sociology		Curriculum
		RT Primary
POLYNESIA	(394)	
BT Countries		PRIMARY (399)
		(Children, program - ages 5 - 8)
POOR ACHIEVERS	(632)	BT Age
RT Achievement		Curriculum
Gifted		Schools
		RT Preschool
Popularity of Sports		Elementary
USE Sport Preferences		Students
POST-SECONDARY	(647)	PRIMITIVE SOCIETIES (400)
BT Schools		(Societies resisting modern
RT Age		changes in civilization)
Secondary		BT Culture
Students		RT Ancient Civilizations
		Preliterate
POSTURE	(395)	
RT Adapted Programs		PRINCE EDWARD ISLAND (401)
		BT Canada

PROBLEM SOLVING APPROACH (566)

(Teaching technique)

RT Creative Movement

Teaching Methods

RT Amateurism

Sports Governing Bodies

PROBLEMS (651)

RT Administration

Policies

Programs

PROGRAMS (405)

(total planning involved)

NT Curriculum

Intramurals

Interscholastic Athletics

Participation

Scheduling

Testing and Measurement

BT Health Education

Physical Education

Recreation

RT Demonstration Projects

Evaluation Problems

Evaluation Social Activities

Surveys

Time Allotment

PROFESSIONAL ASSOCIATIONS (402)

NT AAPHER

AMA

CAPHER

CMA

CPEA

ICHPER

Teachers Associations

PROFESSIONAL PREPARATION (403)

UF Teacher Training

NT Student Teaching

RT Accreditation

Education

Graduate Programs

Teachers

Teaching Methods

Undergraduate Programs

PROMOTION (406)

RT Communications

Public Relations

Proprioceptive Senses

USE Kinesthesia

PROFESSIONAL SPORTS (404)

BT Professionalism

Sports

RT Amateur Sports

Amateurism

Sports Governing Bodies

PROTECTIVE EQUIPMENT (646)

BT Equipment

RT Equipment Testing

Human Body

PROVINCIAL GOVERNMENT (407)

BT Government

RT Federal Government

PROFESSIONALISM (664)

(Code and interpretation)

NT Professional Sports

RT Amateur Sports

PSYCHOLOGY* (408)

NT Behavior

Emotional Measures

Mentally Ill

NT	Motivation		Questionnaire	
	Motor Learning		USE	Surveys
	Personality			
	Personality Adjustment		RACE	(413)
			NT	Caucasian
				Negro
			RT	Racial Intergration
PUBLIC HEALTH		(409)		
NT	Health Services			
RT	Communicable Diseases			
	Diseases		RACIAL INTERGRATION	(414)
			RT	Race
				Social Factors
PUBLIC OPINION		(648)		
RT	Attitude			
	Public Relations		RBC COUNT	(415)
				(red blood cell count)
PUBLIC RELATIONS		(410)	BT	Blood Measures
RT	Administration			
	Communications		REACTION TIME	(416)
	Demonstration, Projects		BT	Motor Performance
	Human Relations		RT	Movement Time
	Parents			Response Time
	Public Opinion			
	Promotion		RECORDS	(417)
				(Health and Physical Educa-
PULSE RATE		(85)		tion)
UF	Brachial Pulse		UF	Inventory
BT	Cardiovascular Measures		RT	Equipment
RT	Blood Measures			Health Services
	Blood Pressure			
	Heart Rate		RECREATION*	(418)
			NT	Programs
PURCHASING		(411)	RT	Games
RT	Budget - Finance			Health Education
	Equipment			Hobbies
	Selection			Interests
	Specifications			Leisure
				Outdoor Education
QUEBEC		(412)		Pastimes
BT	Canada			Physical Education

RT Recreation Centres
 Social Activities

 RECREATION CENTRES (419)
 BT Facilities
 RT Recreation

 Recreation Leaders
 USE Leadership

 RECREATION PROFESSIONALS (420)
 (Administrators Researchers
 Teachers)
 UF Leaders
 NT Administrators
 Teachers
 RT Biographies
 Health Educators
 Personnel
 Physical Educators

 RECRUITMENT (421)
 RT Coaching
 Personnel
 Selection

 RED CROSS SOCIETY (422)
 RT First Aid
 Swimming

 Reducing
 USE Weight Reduction

 Rehabilitation
 USE Correctives

 REINFORCEMENT (652)
 RT Feedback
 Learning
 Motor Learning
 Transfer

RELAXATION (423)
 RT Anxiety
 Emotional Measures
 Stress

 RELIGION (424)
 NT Church
 RT Ethics
 Moral Values

 Remedial Programs
 USE Adapted Programs

 REMINISCENCE (425)
 RT Learning

 RENNAISSANCE (period) (426)
 BT History

 REPORT CARDS (school) (427)
 BT Evaluation
 RT Grading

 RESEARCH (discussion of) (428)
 RT Case Studies
 Philosophy
 Surveys

 RESPIRATION (429)
 NT Cardiorespiratory
 Measures

 RESPIRATORY QUOTIENT (430)
 BT Cardiorespiratory
 Measures

 RESPONSE TIME (431)
 RT Reaction Time

 Retention
 USE Memory

RHYTHMIC ABILITY (644)

RT Motor Ability
Perception
Perceptual Motor Skills
Rhythmics

RHYTHMICS (432)

RT Creative Movement
Creativity
Dance
Folk Dance
Modern Dance
Music
Rhythmic Ability

Rifle Marksmanship

USE Shooting

RINGS (433)

BT Gymnastics

RINKS (Ice) (434)

BT Facilities

Roentogenogram

USE X-ray

ROLLER SKATING (435)

RT Figure Skating
BT Sports

ROMAN (Ancient) (436)

BT Ancient Civilizations

ROWING (437)

(Competitive event)
BT Sports
RT Paddling

RUGGER (438)

BT Sports

RULES (Descriptions for (439)
games and sports)

RT Description of Changes
Officiating
Sports Governing Bodies

RUNNING (440)

UF Distance Running
BT Track and Field
RT Cross Country Running
Sprinting

Rural

USE Environment Factors

RUSSIA (441)

BT Countries

SAFETY (442)

UF Safety Education
NT Accidents
RT Accident Causes
Accident Frequency
Accident Liability
Accident Prevention
First Aid
Injuries
Occupational Health

Safety Education

USE Safety

SAILING (443)

BT Sports

SALARY	(444)	School Success	
RT Job Analysis		USE Academic	
SANITATION	(445)	Score Cards	
BT Health Education		USE Surveys	
SASKATCHEWAN	(446)	SCOTLAND	(450)
BT Canada		BT Countries	
SCHEDULING	(447)	SCOUTING	(451)
BT Programs		BT Sports	
RT Team Teaching		RT Evaluation	
Time Allotment			
School Boards		Screening	
USE Boards of Education		USE Classification	
SCHOOL - COMMUNITY	(448)	SECONDARY (students,	(452)
(School - community co-op-		ages 13 - 19, program)	
eration)		UF Adolescents	
UF Community - School		High School	
RT Community		BT Age	
School Health		Curriculum	
USE Health Education		Schools	
School Nurse		RT Post-Secondary	
USE Health Services		Students	
SCHOOLS	(449)	SEDENTARY INDIVIDUALS	(630)
NT Comprehensive		RT Athletes	
Elementary		Non-Athletes	
Post-Secondary		Participation	
Primary			
Secondary		SELECTION (of players,	(453)
RT Accreditation		equipment and related to	
		personnel recruitment)	
		RT Coaching	
		Equipment	
		Personnel	
		Purchasing	
		Recruitment	

Self Concept		SKIING (snow)	(462)
USE Aspiration Level		RT Cross Country Skiing	
		Jumping	
SENIOR CITIZENS	(454)	Water Skiing	
BT Adults			
Age		Skill Analysis	
		USE Mechanical Analysis	
SEX	(455)		
NT Boys		Skilled Individuals	
Girls		USE Athletes	
Men			
Women		Skill Learning	
		USE Motor Learning	
SEX EDUCATION	(456)		
BT Education		Skills	
Health Education		USE Motor Skills	
RT Family Life Education			
Menstruation		SKINFOLD MEASURES	(463)
Venereal Diseases		RT Body Density	
		Fat	
SHOOTING (rifle)	(457)		
UF Rifle Marksmanship		SLOW LEARNERS	(464)
		RT Ability	
SHOT PUT	(458)	Handicapped	
BT Track and Field		Special Education	
SHOULDER	(459)	SMOKING	(465)
BT Human Body		UF Tobacco	
		BT Health Education	
SIDE HORSE	(460)	RT Alcoholism	
BT Gymnastics			
		SOCCER	(466)
SKELETAL AGE	(461)	BT Sports	
RT Age		RT Kicking	
Maturity		SOCIAL ACTIVITIES	(643)
X-ray		SOCIAL ADJUSTMENT	(467)
		UF Peer Status	
		BT Adjustment	

RT	Aims -- Objectives	UF	Physique
	Social Activities	NT	Anthropometric Measures
	Social Factors		Body Build
	Sociometry	BT	Classification
		RT	Body Density
SOCIAL FACTORS	(468)		Height
	(in physical education, health, and recreation, individual and group)		Weight
BT	Culture	SOUTH AMERICA	(631)
RT	Economic Factors	SPAIN	(474)
	Racial Intergration	BT	Countries
	Social Adjustment		
	Sociology	SPECIAL EDUCATION	(475)
		BT	Education
Social Image		RT	Emotionally Handicapped
USE	Social Adjustment		Mentally Handicapped
			Slow Learners
SOCIO-ECONOMIC STATUS	(469)		
RT	Social Factors	SPECIFICATIONS	(476)
	Economic Factors		(Equipment, etc.)
		RT	Equipment
SOCIOLOGY	(470)		Facilities
RT	Economic Factors		Purchasing
	Laws		
	Political Factors	SPECIFICITY (relating to	(477)
	Social Factors		skill learning)
	Economic Factors	RT	Learning
			Motor Learning
SOCIOMETRY	(471)		
RT	Social Adjustment	SPEED (of movement)	(478)
		BT	Motor Performance
SOFTBALL	(472)	RT	Agility
RT	Baseball		Fitness
BT	Sports		Movement Time
SOMATOTYPING	(473)	SPEED SKATING	(479)
UF	Physical Development	BT	Ice Skating

SPORT PREFERENCES (480)

RT Interests

SPORTS (games of high organization) (481)

UF Activities

NT Amateur Sports

Archery

Badminton

Baseball

Basketball

Bowling

Boxing

Cricket

Cross Country Running

Cross Country Skiing

Curling

Cycling

Diving

Equestrian

Fencing

Field Hockey

Figure Skating

Fishing

Football

Golf

Gymnastics

Handball

Hockey

Horse Racing

Hunting

Judo

Lacrosse

Paddling (canoe, kayaking)

Professional Sports

Roller Skating

Rowing

Rugger

NT Sailing

Shooting

Skiing

Soccer

Sogtball

Speed Skating

Squash

Surfing

Swimming

Synchrized Swimming

Tennis

Track and Field

Volleyball

Wrestling

RT Competition

Pastimes

Players

Playing Fields

SPORTS GOVERNING BODIES (482)

NT AAC of C

RT Amateur Sports

Amateurism

Government

Professional Sports

Professionalism

Rules

Sports

SPORTSMANSHIP (483)

RT Ethics

Moral Values

SPRINT START (485)

BT Sprinting

SPRINTING (484)

NT Sprint Start

BT Swimming		Strength Development	
Track and Field		USE Strength	
RT Running		Strength Measures	
SQUASH	(486)	USE Testing and Measurement	
BT Sports		STRESS (physical pressure (491)	
Staleness		or emotional strain)	
USE Motivation		UF Tension	
STATISTICAL ANALYSIS	(487)	NT Electrical Stress	
NT Factor Analysis		BT Emotional Measures	
Normative Studies		RT Anxiety	
Surveys		Fatigue	
RT Statistical Data		Force	
		Motivation	
		Relaxation	
STATISTICAL DATA	(488)	STUDENT ATTITUDES	(492)
RT Statistical Analysis		BT Attitudes	
Surveys			
STEEPLECHASE	(489)	STUDENT TEACHING	(494)
BT Track and Field		UF Practice Teaching	
		BT Professional Preparation	
STRENGTH	(490)	RT Teachers	
UF Grip Strength		Undergraduate Programs	
Power			
Strength Development		STUDENTS	(493)
NT Concentric Strength		RT Age	
Eccentric Strength		Elementary	
Isometric Strength		Graduate Programs	
Isotonic Strength		Post-Secondary	
BT Fitness		Primary	
RT Cable Tension Strength		Secondary	
Dynamometers		Undergraduate Programs	
Human Body			
Testing and Measurement		Stunts and Tumbling	
Training		USE Tumbling	
Transfer			

SUPERVISION (495)

RT Personnel

SURFING (496)

BT Sports

SURVEYS (497)

UF Questionnaire
Score Card

RT Comparative Analysis
Evaluation Programs
Research
Statistical Analysis
Statistical Data

SWEDEN (498)

BT Countries

SWIMMING (499)

NT Backstroke
Breaststroke
Butterfly Stroke
Crawl Stroke
Sprinting
Synchronized Swimming
BT Aquatics
Sports

SWIMMING POOLS (500)

BT Facilities

SYNCHRONIZED SWIMMING (501)

BT Aquatics
Swimming
Sports

TAIWAN (502)

BT Countries
RT China

TEACHER ASSOCIATIONS (503)

BT Professional Associations

TEACHER ATTITUDES (504)

BT Attitudes

TEACHER CERTIFICATION (505)

UF Certification Requirements
BT Professional Preparation
RT Accreditation
Evaluation

TEACHERS (506)

NT Classroom Teachers
BT Health Educators
Physical Educators
Recreation Professionals
RT Personnel
Professional Preparation
Student Teaching
Teacher Associations
University Faculty

Teacher Training

USE Professional Preparation

Teaching

USE Teaching Methods

TEACHING METHODS (507)

UF Methods
Part Method
Teaching
Whole Part Method
RT Coaching
Inservice Training
Motor Learning
Problem Solving
Professional Preparation

RT Team Teaching

TEAM TEACHING (and planning) (508)

RT Scheduling

Teaching Methods

TELEMETRY (equipment) (509)

BT Laboratory Equipment

TELEVISION (661)

BT Instructional Materials

Visual Equipment

TEMPERATURE (510)

UF Cold

Heat

Hot

RT Blood Measures

Cardiovascular Measures

Dehydration

TENNIS (511)

BT Sports

TENNIS COURTS (512)

BT Facilities

Tension

USE Stress

TEST CONSTRUCTION (513)

RT Testing and Measurement

Tests

TESTING AND MEASUREMENT (514)

UF Measurement

Strength Measures

BT Evaluation

BT Programs

RT Attitudes

Bicycle Ergometer

Equipment

Equipment Testing

Fitness

Grading

Knowledge

Motor Skills

Social Adjustment

Sociometry

Strength

Test Construction

Tests

Treadmill

TESTS (description and (515)

review of)

RT Curriculum

Test Construction

Testing and Measurement

THEORY DEVELOPMENT (516)

RT Description of Changes

Philosophy

Play

Therapy

USE Physical Therapy

Treatment of Injuries

THROWING (or pitching) (517)

RT Baseball

Football

Track and Field

TIME (important factor) (518)

RT Force

RT	Impulse		Trainer	
	Velocity		USE	Treatment of injured
TIME ALLOTMENT	(649)	TRAINING	(521)	
RT	Curriculum		(Techniques and programs)	
	Programs	UF	Conditioning Programs	
	Scheduling	NT	Circuit Training	
			Interval Training	
Timing			Weight Training	
USE	Coordination	RT	Fitness	
			Strength	
Tobacco			Transfer	
USE	Smoking			
TRACK	(519)	TRAINING ROOM	(662)	
BT	Facilities	BT	Facilities	
		RT	Treatment of Injuries	
TRACK AND FIELD	(520)	TRAMPOLINE	(522)	
NT	Cross Country	BT	Gymnastics	
	Decathlon	RT	Tumbling	
	Discus Throw			
	Hammer Throw	TRANSFER (psychology)	(523)	
	High Jump	RT	Motor Ability	
	Hurdles		Motor Educability	
	Javelin Throw		Motor Learning	
	Long Jump		Motor Skills	
	Marathon		Reinforcement	
	Pentathlon		Strength	
	Running		Training	
	Shot Put			
	Sprinting	TREADMILL	(524)	
	Sprint Start	RT	Cardiorespiratory Muscles	
	Steeplechase		Fitness	
	Tripple Jump		Testing and Measurement	
	Walking		Work Capacity	
BT	Sports			
RT	Jumping	TREATMENT OF INJURIES	(525)	
	Throwing	UF	Therapy	

UF	Trainer		RT	Physical Educators	
BT	Injuries			Teachers	
RT	Physical Therapy				
	Training Room		Urban		
			USE	Environment Factors	
TRIPLE JUMP		(526)			
UF	Hop, Step, and Jump		Values	in Physical Education	
BT	Track and Field		USE	Aims - Objectives	
				Moral Values	
TUMBLING		(527)		Philosophy	
UF	Stunts and Tumbling				
RT	Gymnastics		VAULTING		(533)
	Trampoline		BT	Gymnastics	
UNDERGRADUATE PROGRAMS		(528)	VELOCITY (Analysis of		(534)
BT	Curriculum			movement)	
RT	Graduate Programs		RT	Impulse	
	Professional Preparation			Kinesiology	
	Students			Mechanical Analysis	
	Student Teaching			Time	
UNEVEN PARALLELS		(529)	VENEREAL DISEASES		(663)
BT	Gymnastics		RT	Health Education	
				Sex Education	
UNITED KINGDOM		(226)			
NT	England		VERBAL LEARNING		(535)
BT	Countries		BT	Learning	
			RT	Motor Learning	
UNITED STATES		(530)			
BT	Countries		VISION		(536)
			UF	Aye Movement	
			NT	Blind	
UNIVERSITIES		(531)	BT	Perception	
UF	Colleges		RT	Perceptual Motor Skills	
RT	Accreditation				
	Intercollegiate Athletes				
			VISUAL EQUIPMENT		(537)
UNIVERSITY FACULTY		(532)	NT	Television	
UF	Faculty		BT	Equipment	

BT Instructional Materials	RT Height
RT Films	Human Body
Photographs	Obesity
	Somatotyping
Vital Capacity	Weight Training
USE Cardiorespiratory	
Measures	WEIGHT LIFTING (Competition) (544)
	RT Weight Training
Vitamins	
USE Nutrition	WEIGHT REDUCTION (545)
	UF Reducing
VOLLEYBALL (538)	BT Weight
BT Sports	RT Body Density
	Calorie Consumption
Waistline	Dehydration
USE Abdomen	Exercise
	Fat
WALVRES (539)	Obesity
RT Accident Liability	Wrestling
Accidents	
	WEIGHT TRAINING (overload) (546)
WALKING (includes Competition) (540)	BT Training
BT Track and Field	RT Body Build
	Exercise
WARM-UP (541)	Weight
RT Fitness	Weight Lifting
Motor Performance	WEST EUROPE (657)
	WOMEN (547)
WATER SKIING (542)	RT Girls
RT Skiing (snow)	
	WOMENS ATHLETICS (548)
WEIGHT (543)	BT Athletics
UF Body Weight	RT Menstruation
NT Weight Reduction	
BT Body Build	WORK CAPACITY (related to (549)
Body Density	body capacity and efficiency)
Calorie Consumption	BT Cardiovascular Measures
Fat	RT Bicycle Ergometer

RT Fitness
Treadmill

YWHA (Young Womens Hebrew (557)
Association)

RT YWCA

Work Load

USE Job Analysis

Workers (related to industry)

USE Industry

WORLD CHAMPIONSHIPS (550)

BT Championships
International Games

WRESTLING (551)

BT Sports
RT Weight Reduction

WRIST (642)

BT Human Body
Joints

X-RAY (552)

UF Roentogenogram
RT Skeletal Age

YMCA (Young Mens Christian (553)
Association)

RT YMCA

YMHA (Young Mens Hebrew Assoc.) (554)

YOUNG ADULTS (555)

BT Adults
Age

YWCA (Young Womens Chris- (556)
tian Association)

RT YWHA

APPENDIX "A"

Terms for Dating Historical and Comparative Information and/or Year of Study

In addition to the descriptive terms in the main body of the thesaurus, ie. Preliterate, Ancient Civilizations, Modern Byzantine, Medieval, Renaissance - the following terms (dates) may be used to specifically indicate the year or years in history for which the information is collected.

Beginning in 1960, each year following is included as a term which is to be used in tagging the year the study has been completed and the year pertinent to the information in the document.

All years prior to the birth of Christ (BC) may be described each 100 years with the following terms. The term "100 BC" is meant to index and indicate the years 1 BC to 100 BC inclusive, and "200 BC" covers the period between the years 101 BC and 200 BC.

The years 100 AD to 1000 AD may be used to index and retrieve information pertinent to each 100 years in this period. The period from 1050 to 1800 may be indexed each 50 years, from 1800 to 1940 every 10 years, from 1940 to 1960 every 5 years, and each year may be employed from 1960 to the present.

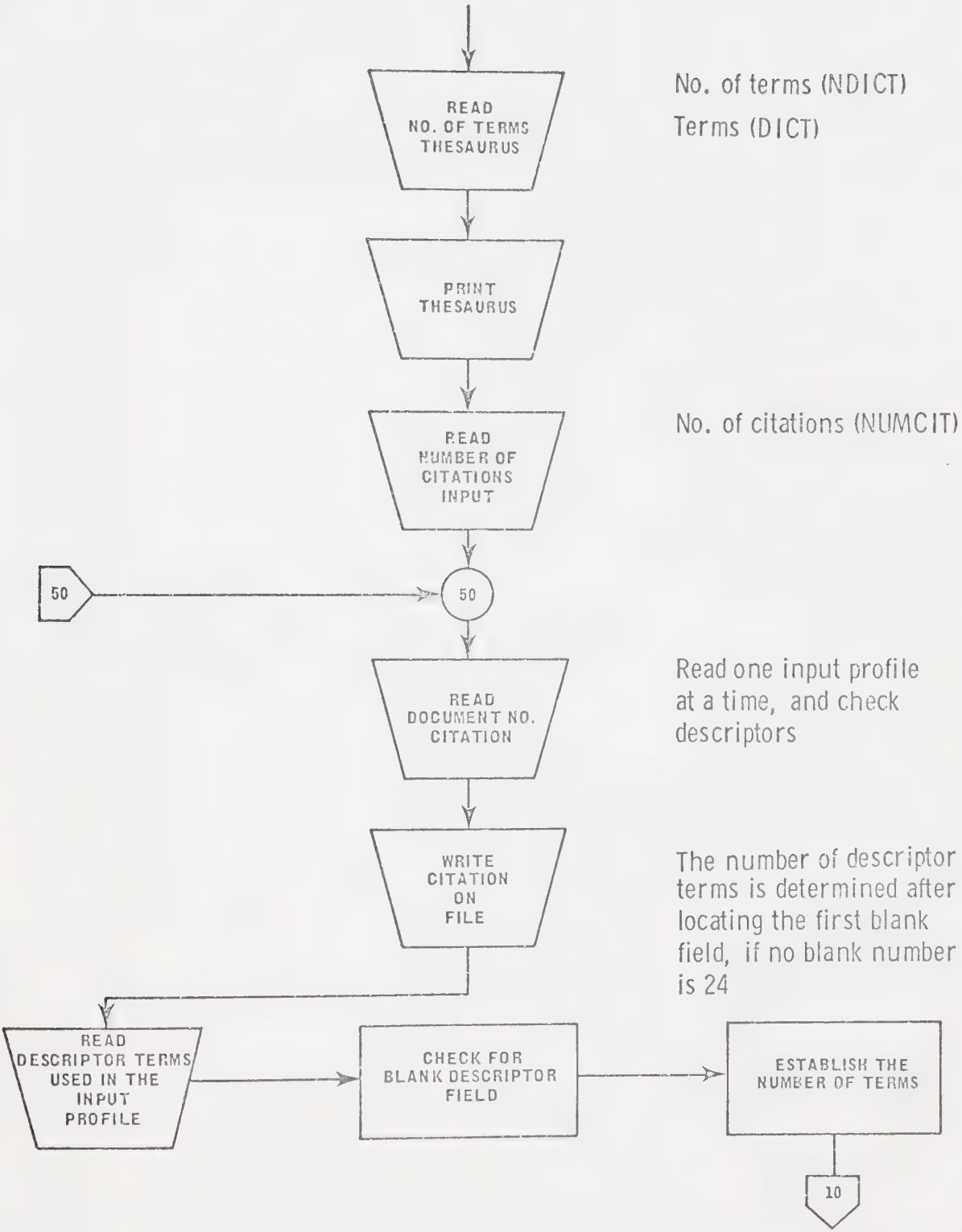
Authorized Descriptors

100 BC	(567)	1650	(598)
200 BC	(568)	1700	(599)
300 BC	(569)	1750	(600)
400 BC	(570)	1800	(601)
500 BC	(571)	1810	(602)
600 BC	(572)	1820	(603)
700 BC	(573)	1830	(604)
800 BC	(574)	1940	(605)
900 BC	(575)	1850	(606)
		1860	(607)
100 AD	(576)	1870	(608)
200 AD	(577)	1880	(609)
300 AD	(578)	1890	(610)
400 AD	(579)	1900	(611)
500 AD	(580)	1910	(612)
600 AD	(581)	1920	(613)
700 AD	(582)	1930	(614)
800 AD	(583)	1940	(615)
900 AD	(584)	1945	(616)
1000 AD	(585)	1950	(617)
1050	(586)	1955	(618)
1100	(587)	1960	(619)
1150	(588)	1961	(620)
1200	(589)	1962	(621)
1250	(590)	1963	(622)
1300	(591)	1964	(623)
1350	(592)	1965	(624)
1400	(593)	1966	(625)
1450	(594)	1967	(626)
1500	(595)	1968	(627)
1550	(596)	1969	(628)
1600	(597)	1970	(629)

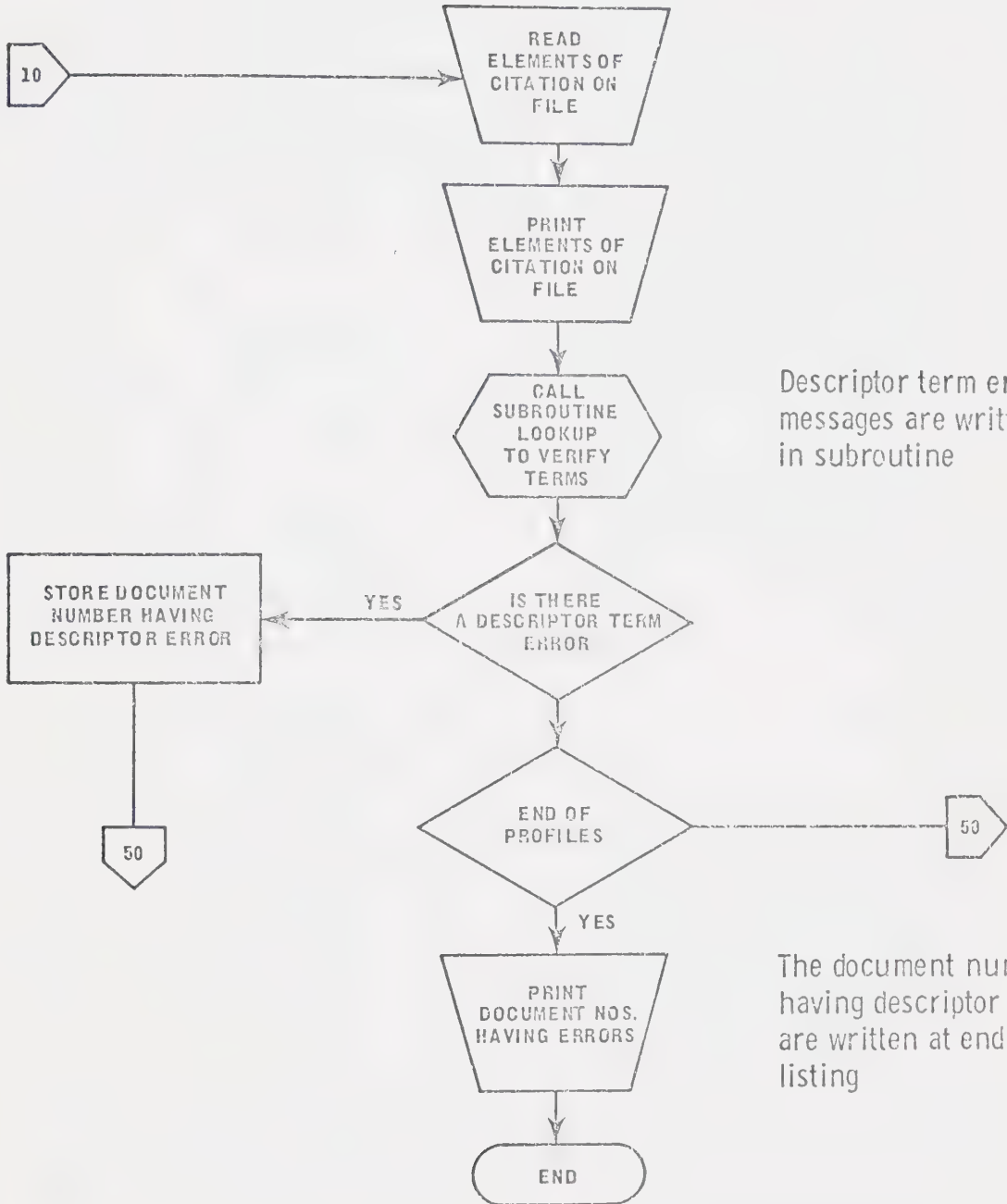
APPENDIX F

The Flow Diagrams

PRE-FILE

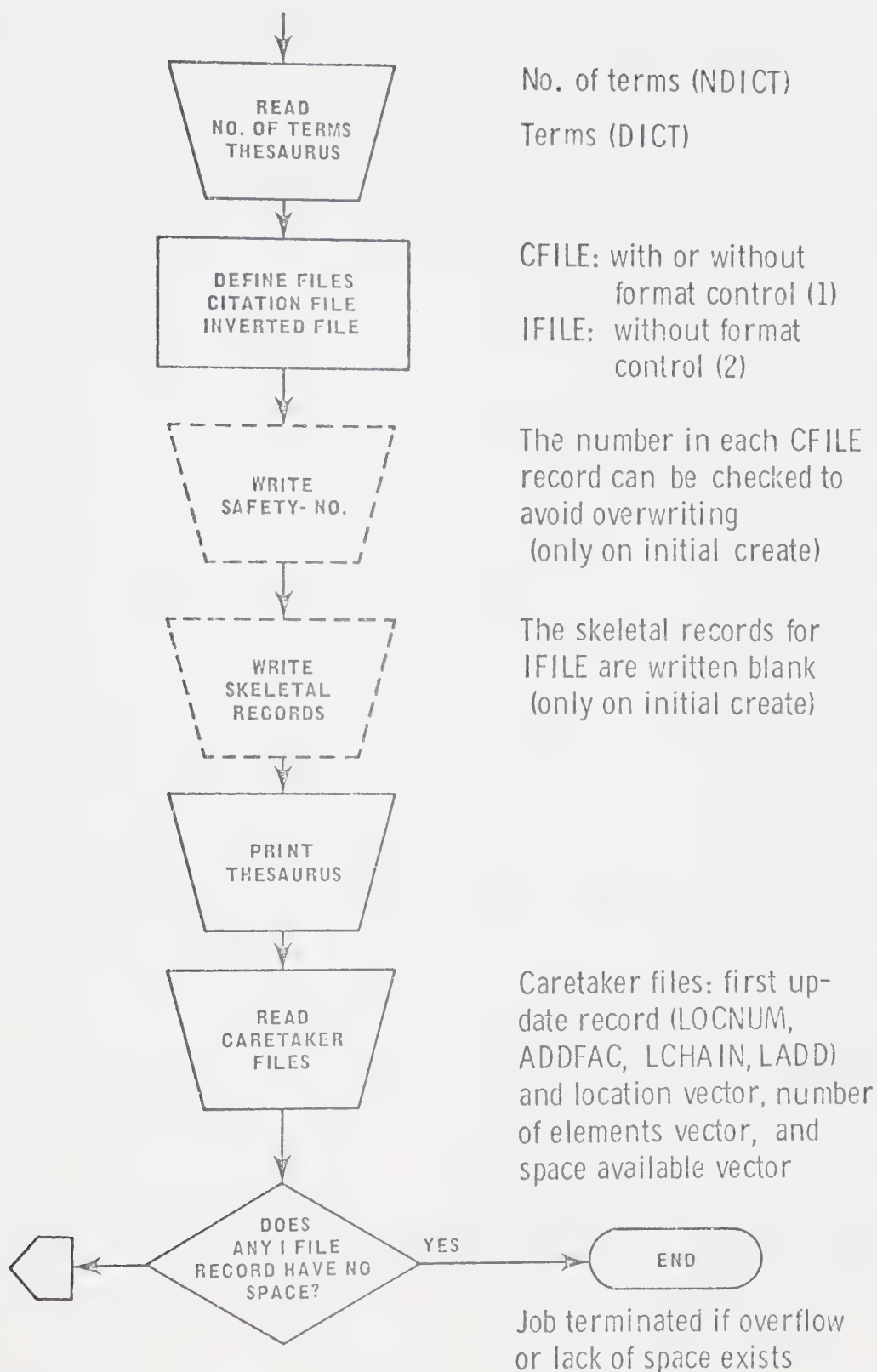


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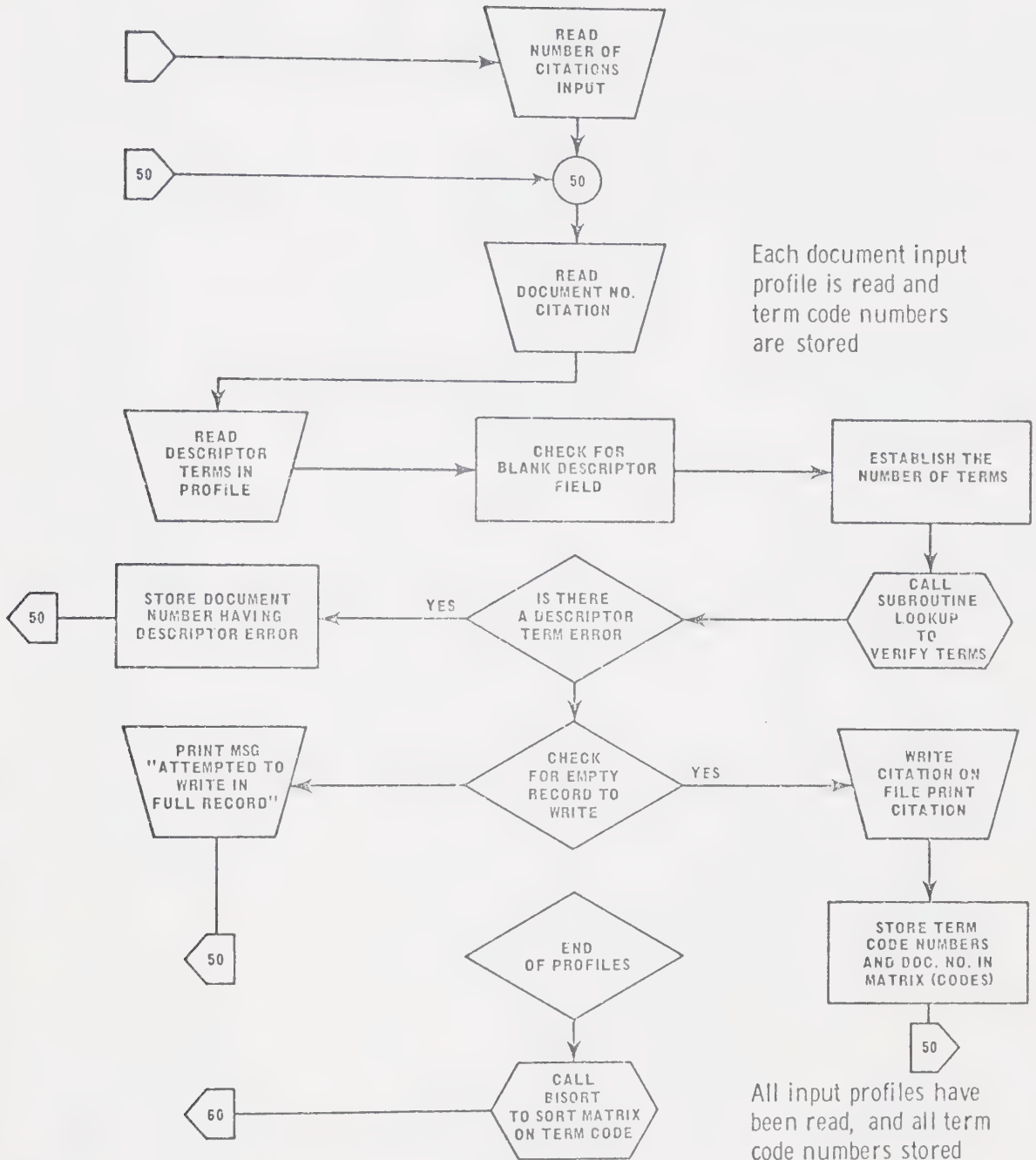


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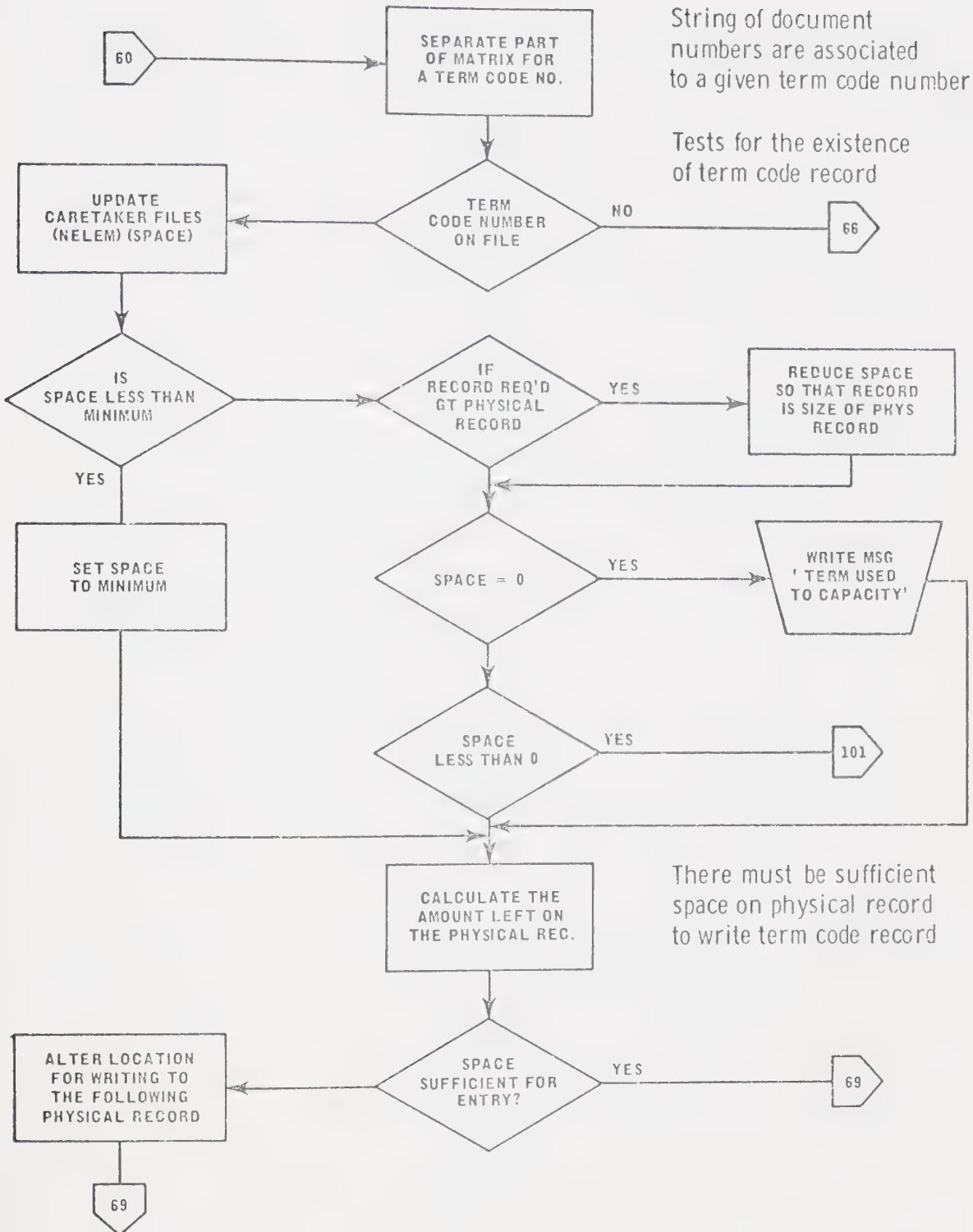
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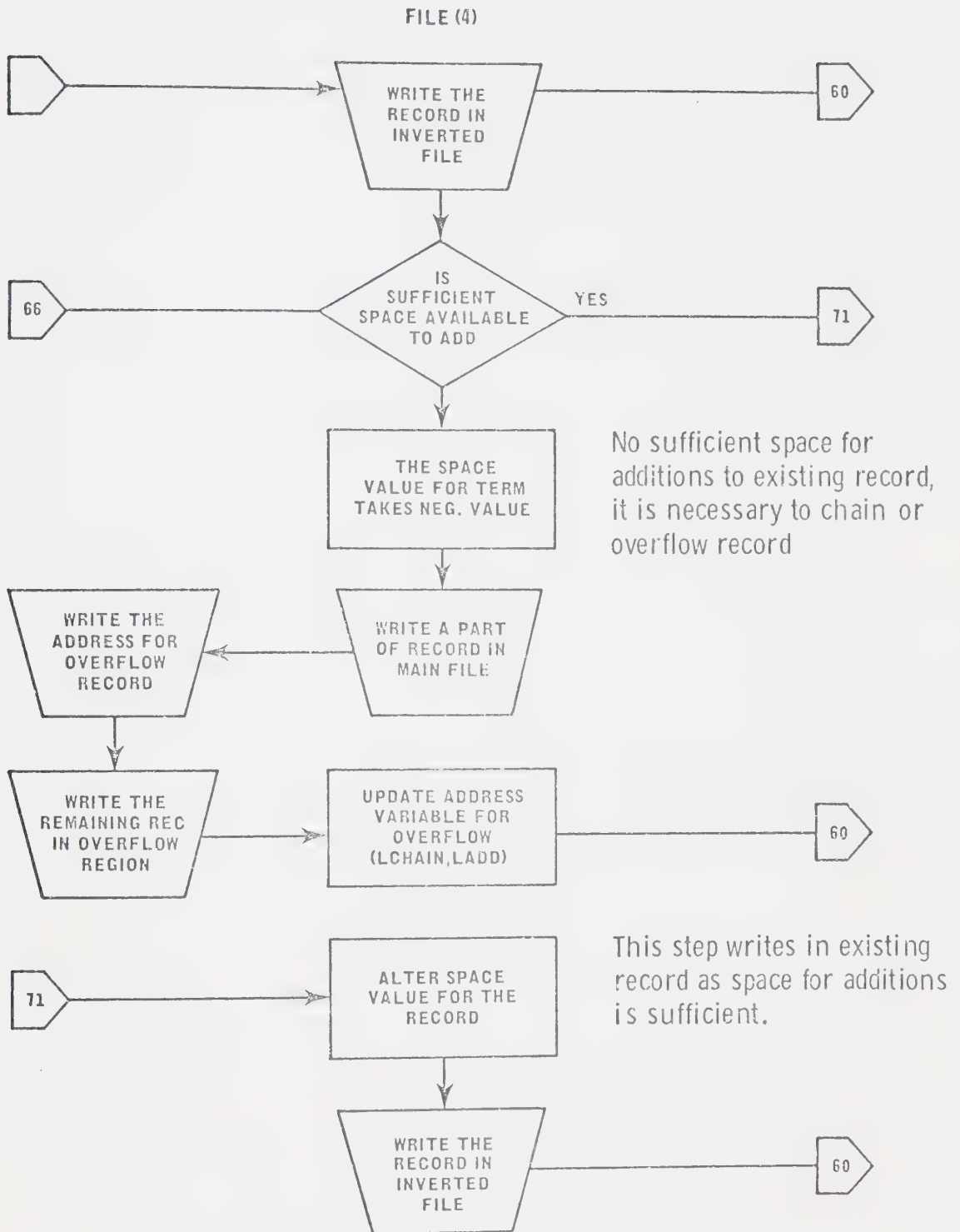


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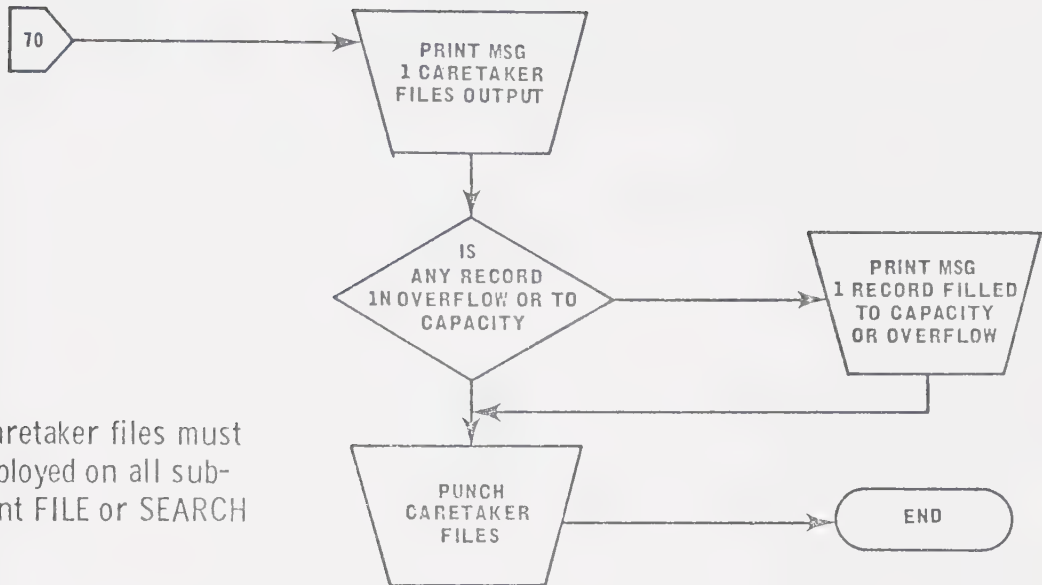


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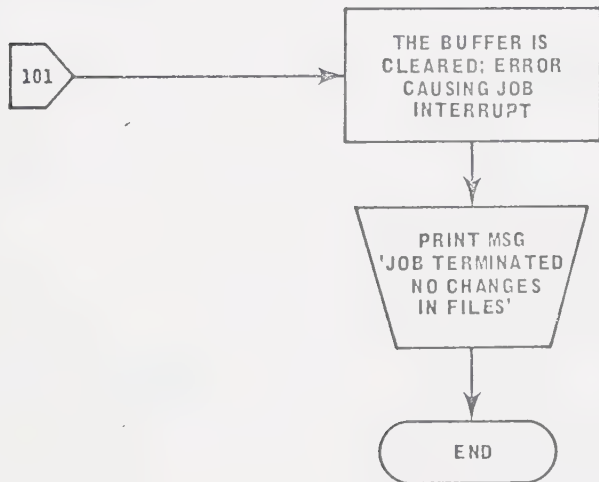




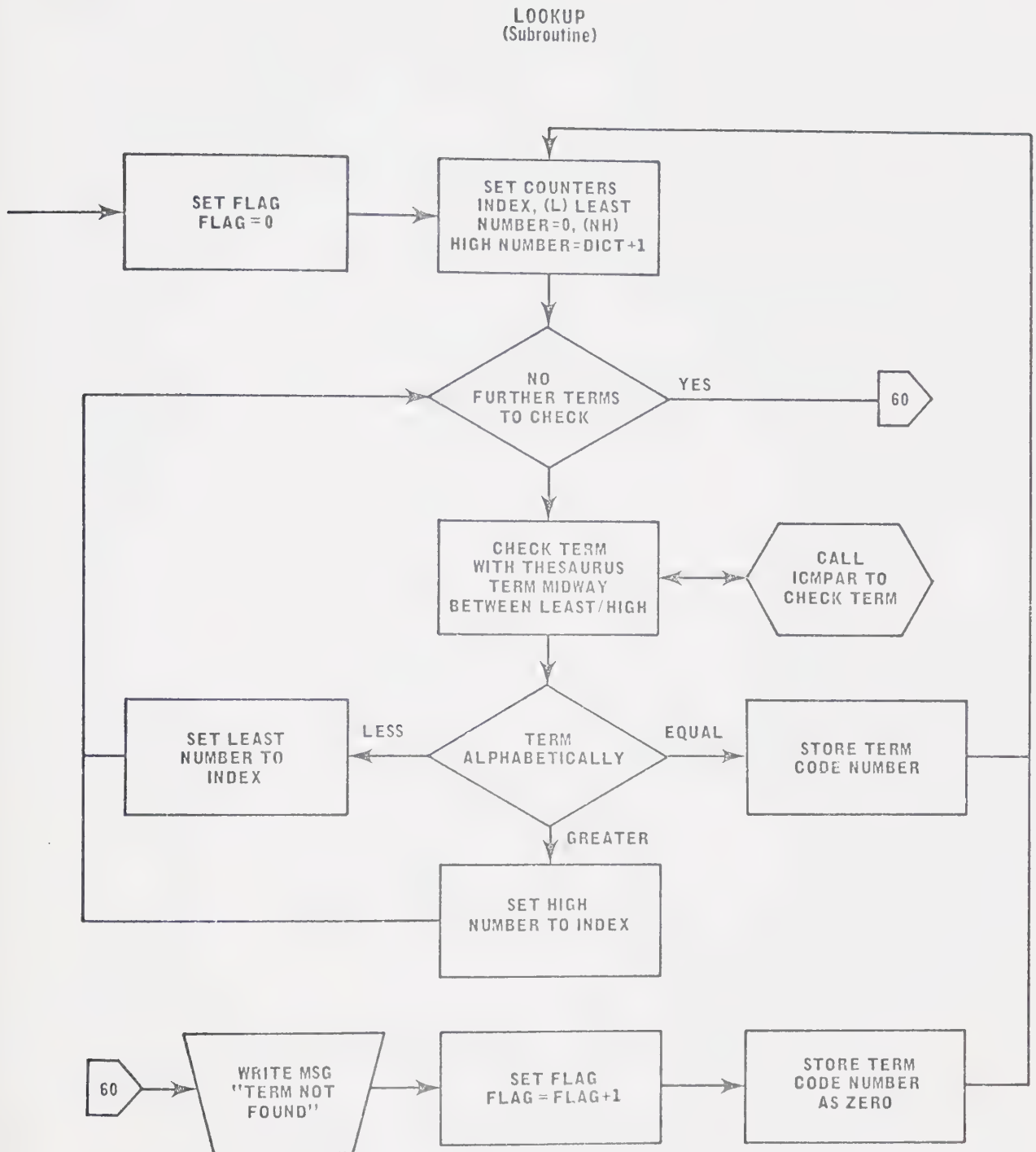
FILE (5)



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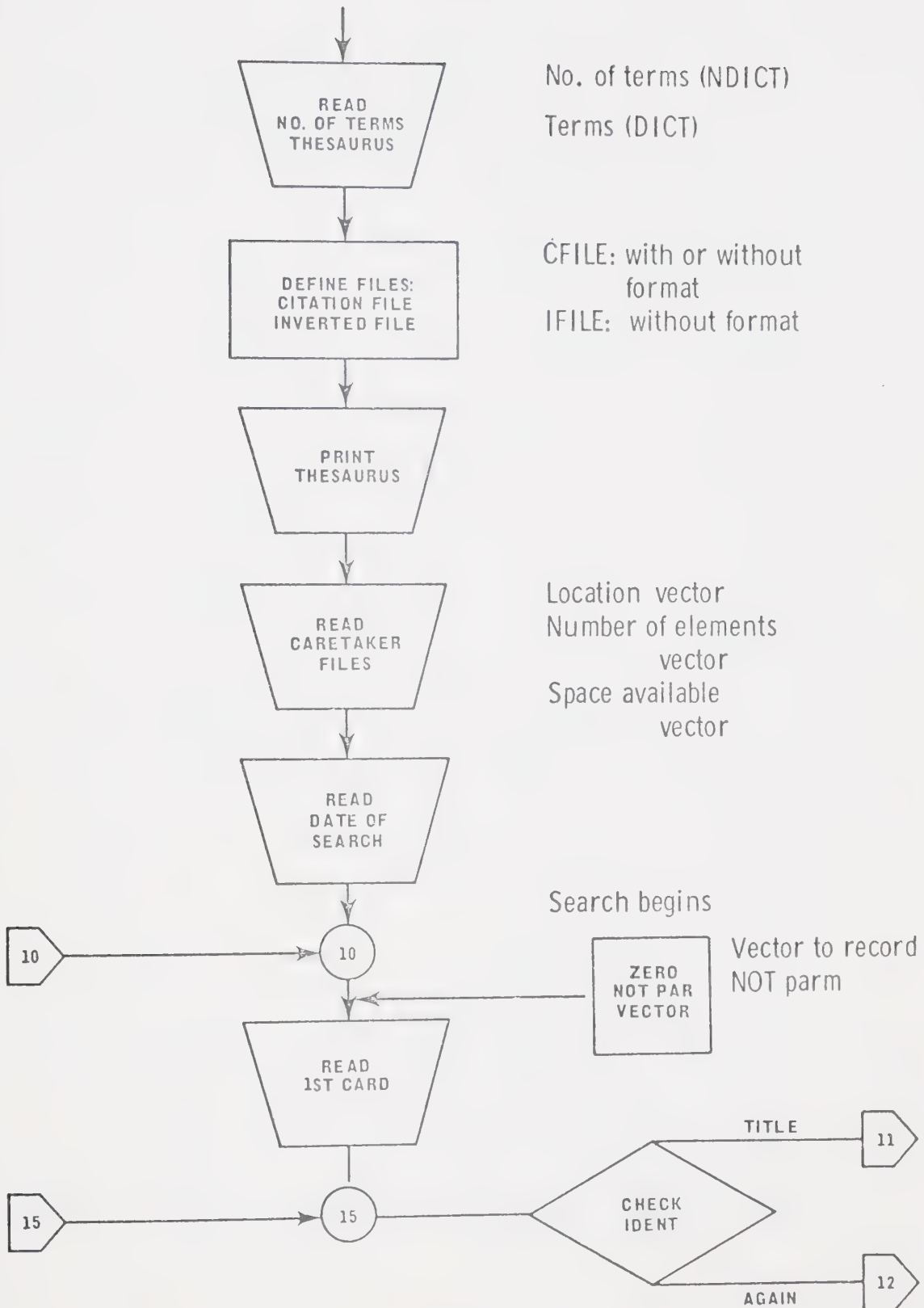


Buffer cleared by writing two blanks, interrupt caused by intentional address error

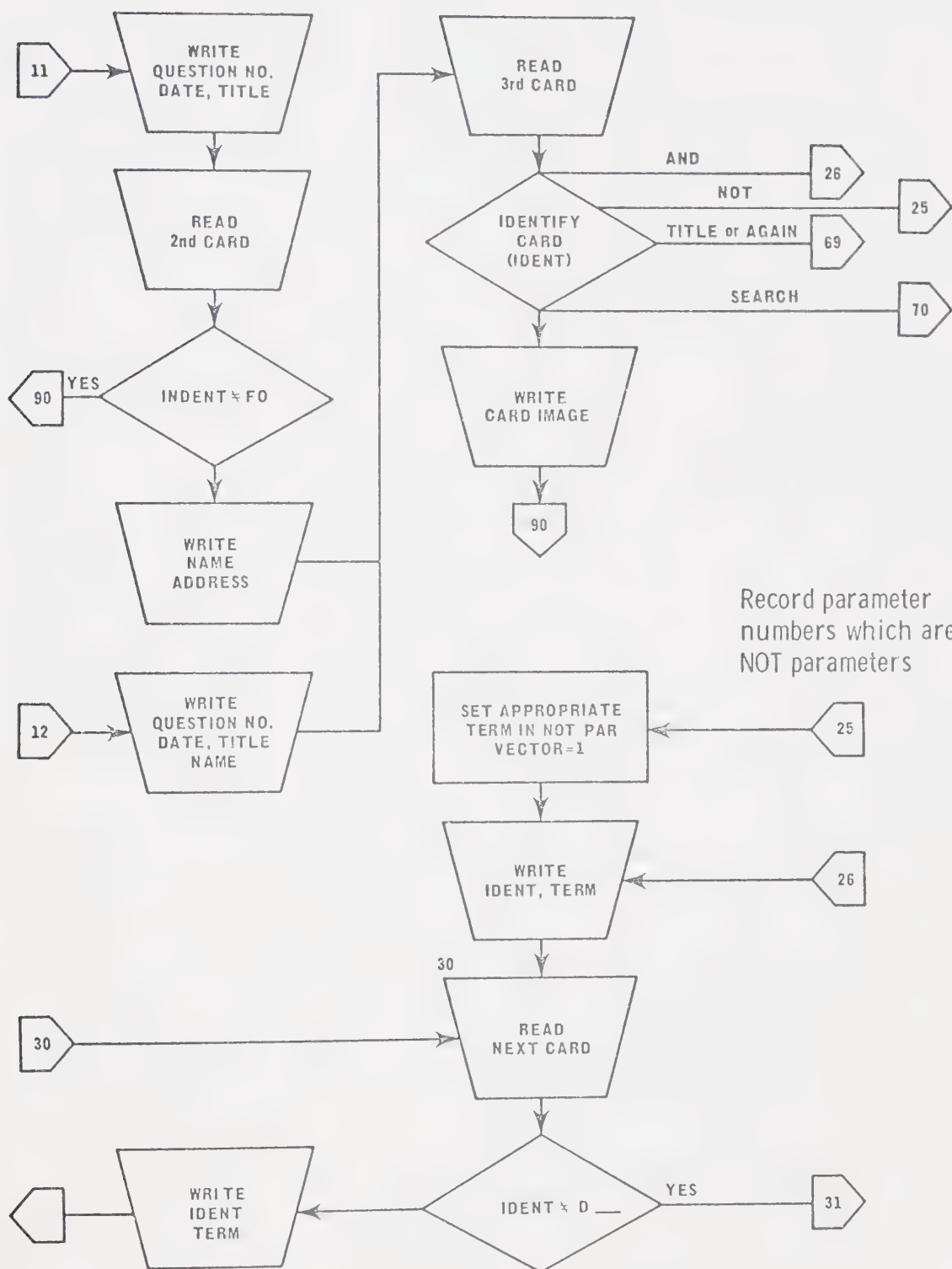


N.S. This routine verifies each term in the array passed to the subroutine from the mainline FILE, and one term is passed at a time from the mainline SEARCH.

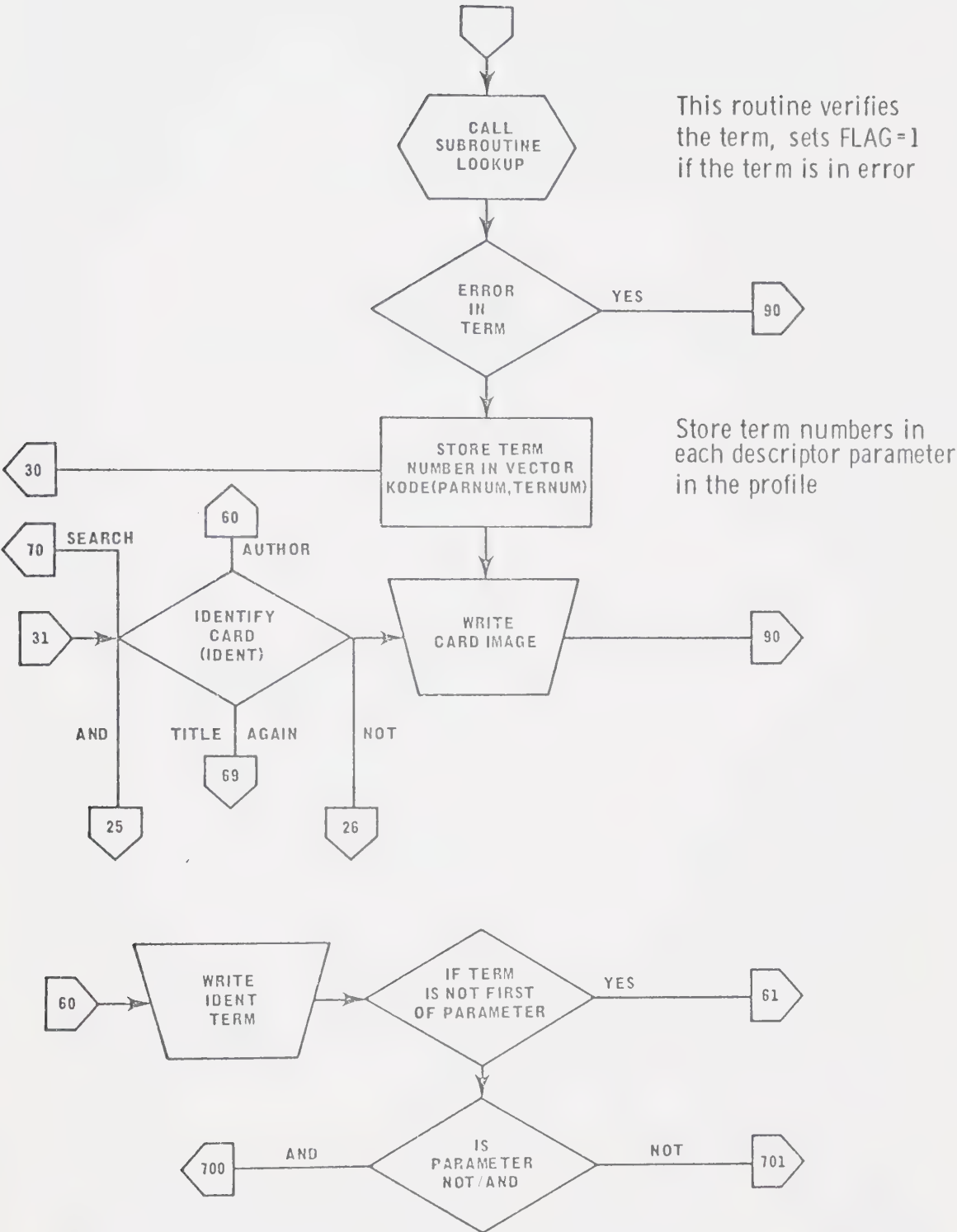
SEARCH



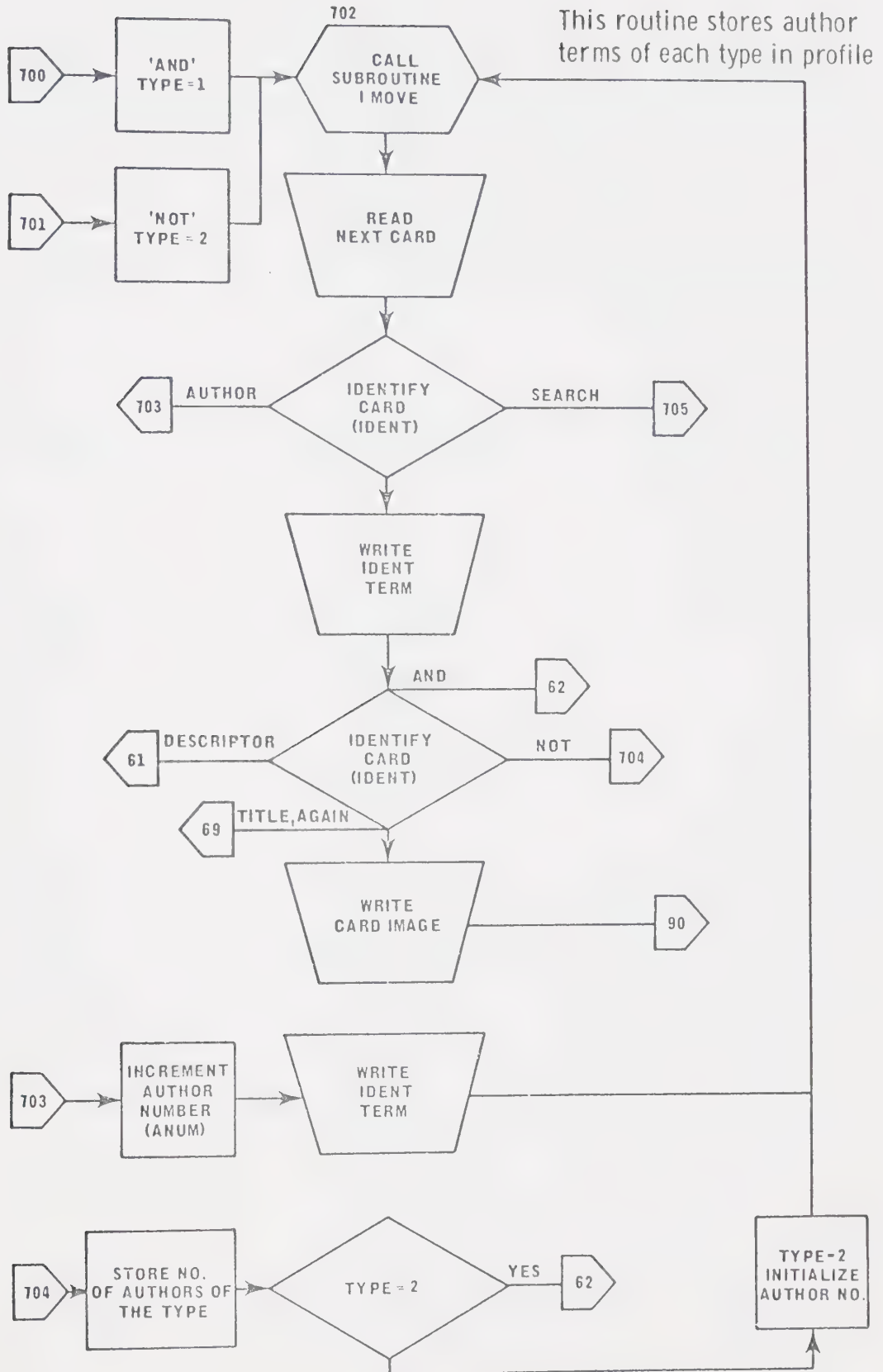
SEARCH (2)



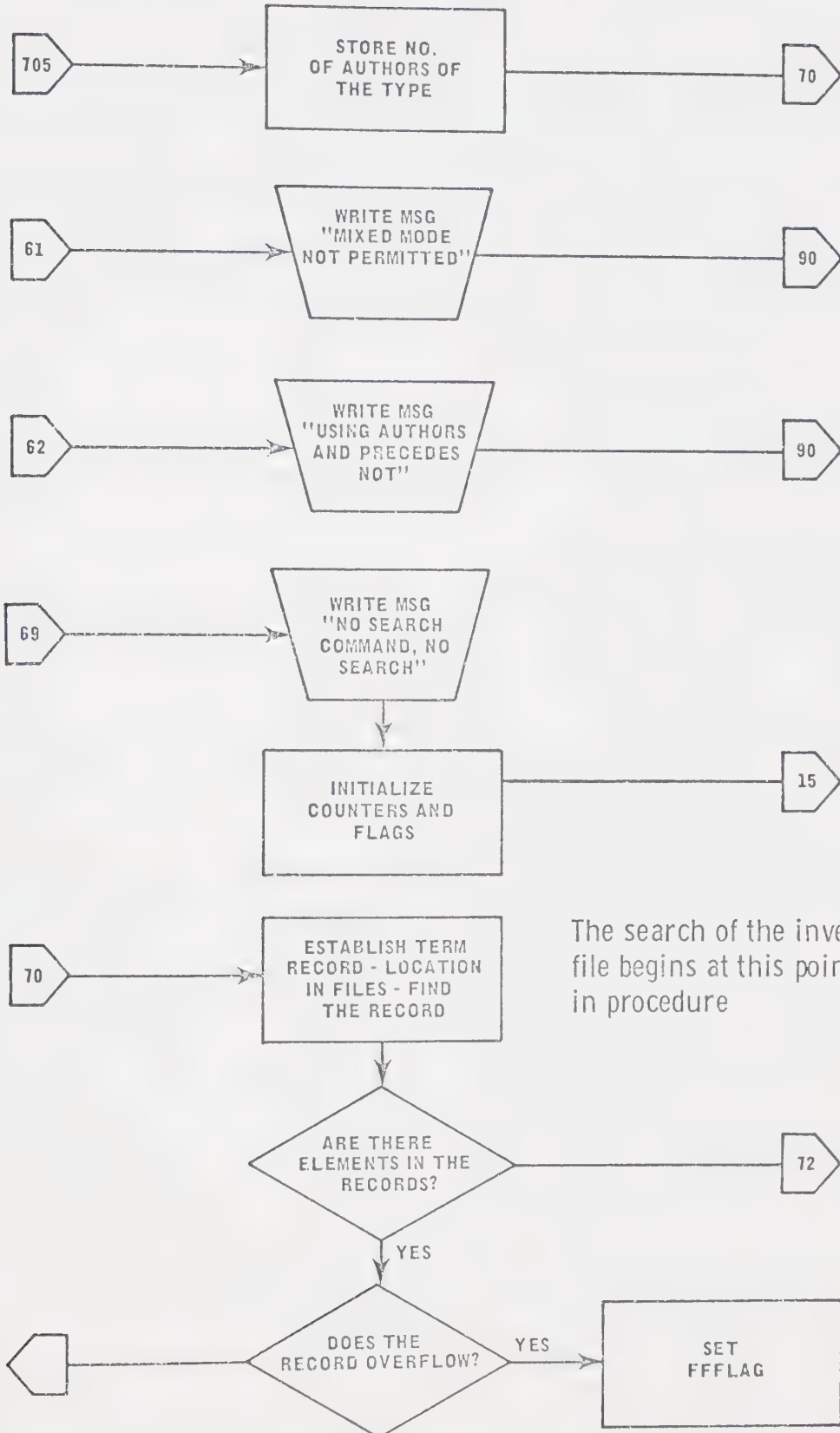
SEARCH (3)



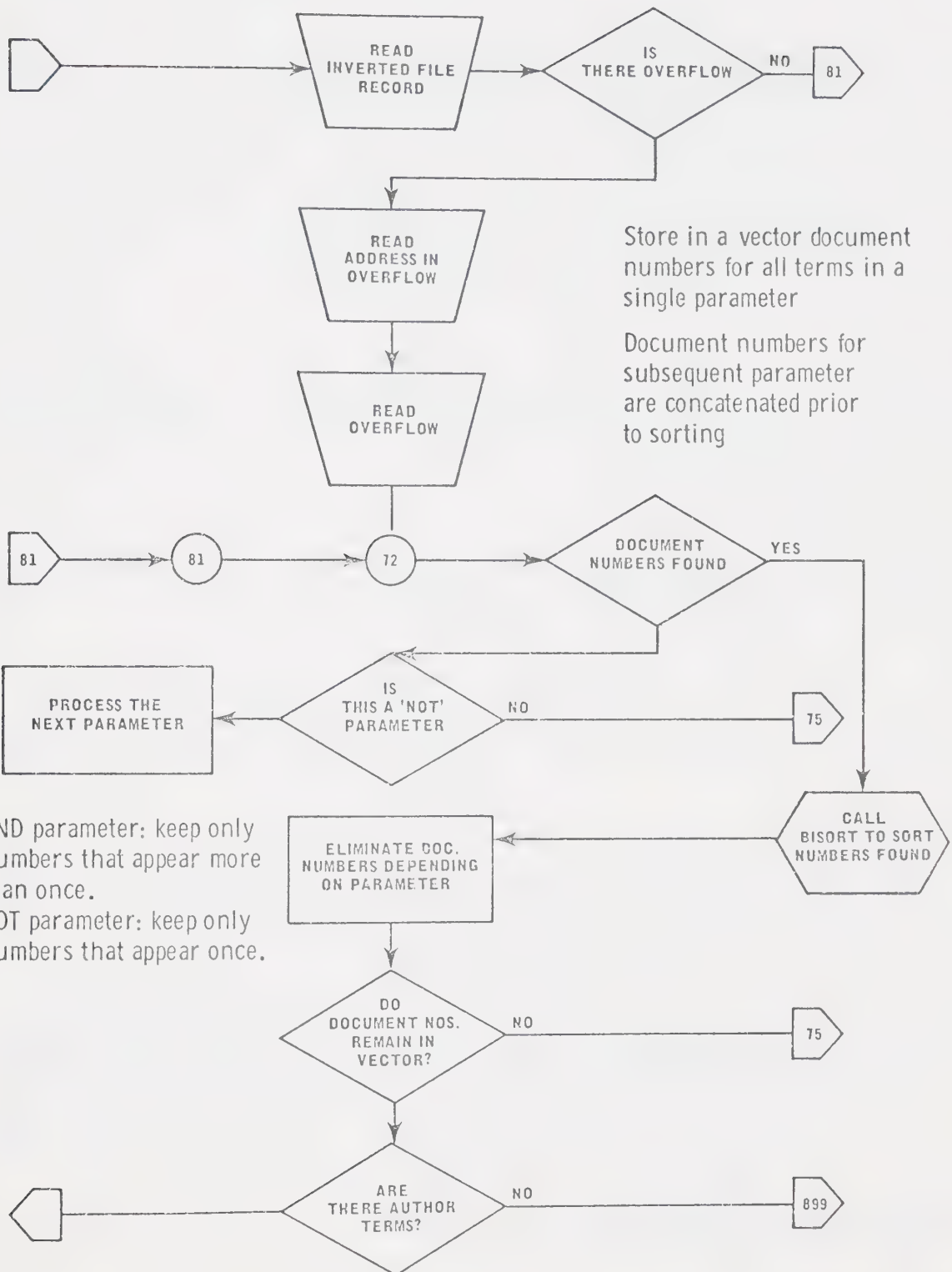
SEARCH (4)



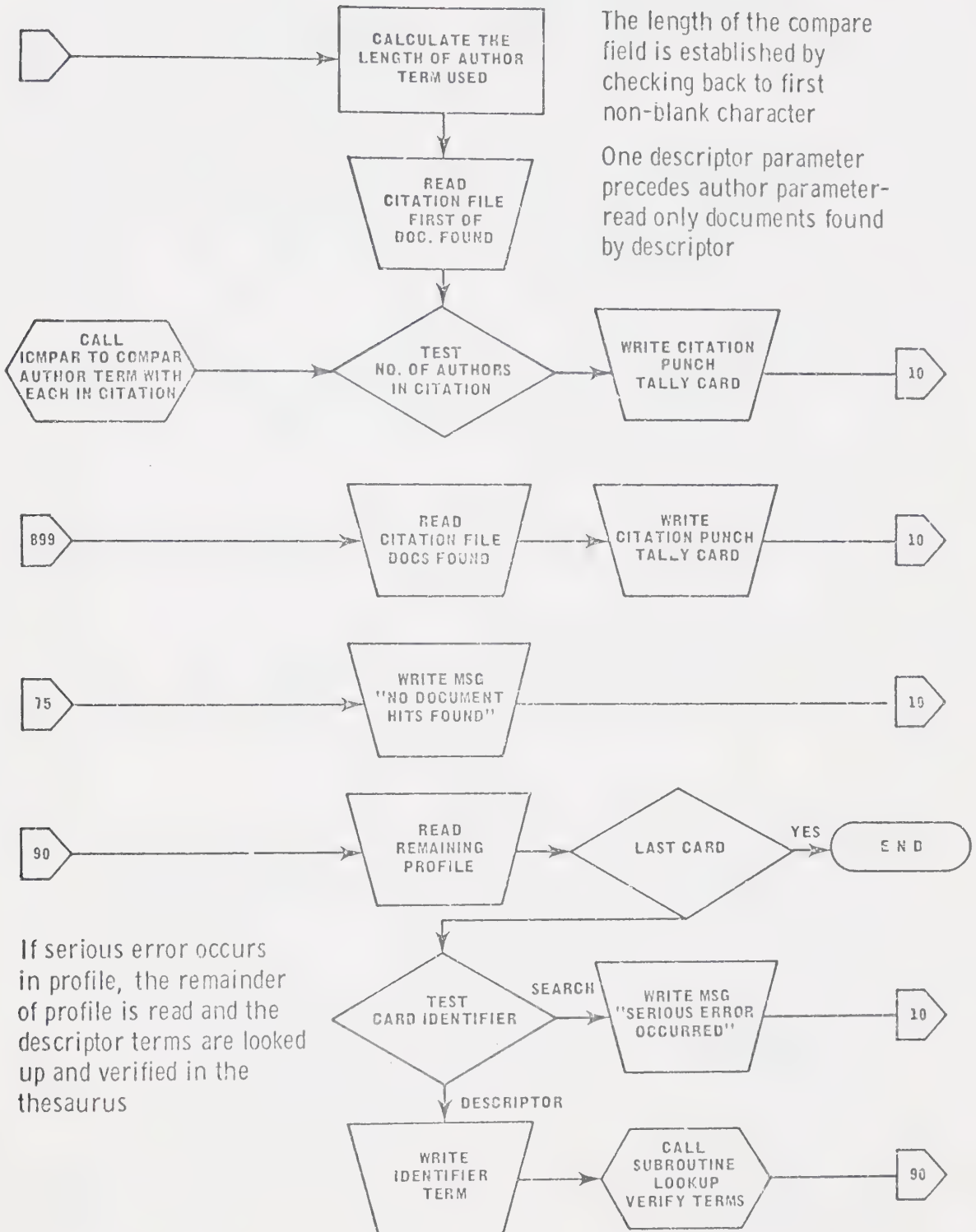
SEARCH (5)



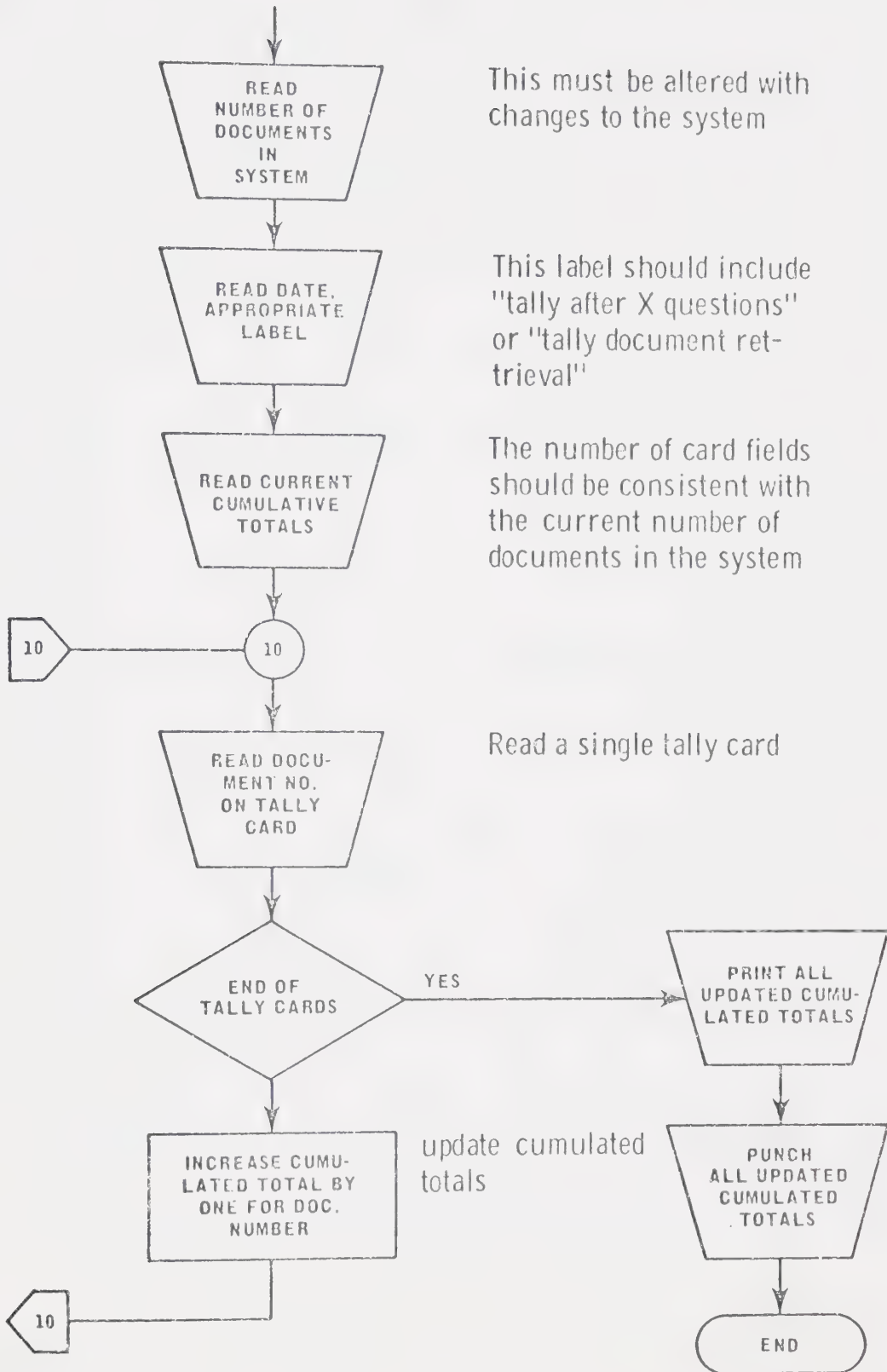
SEARCH (6)

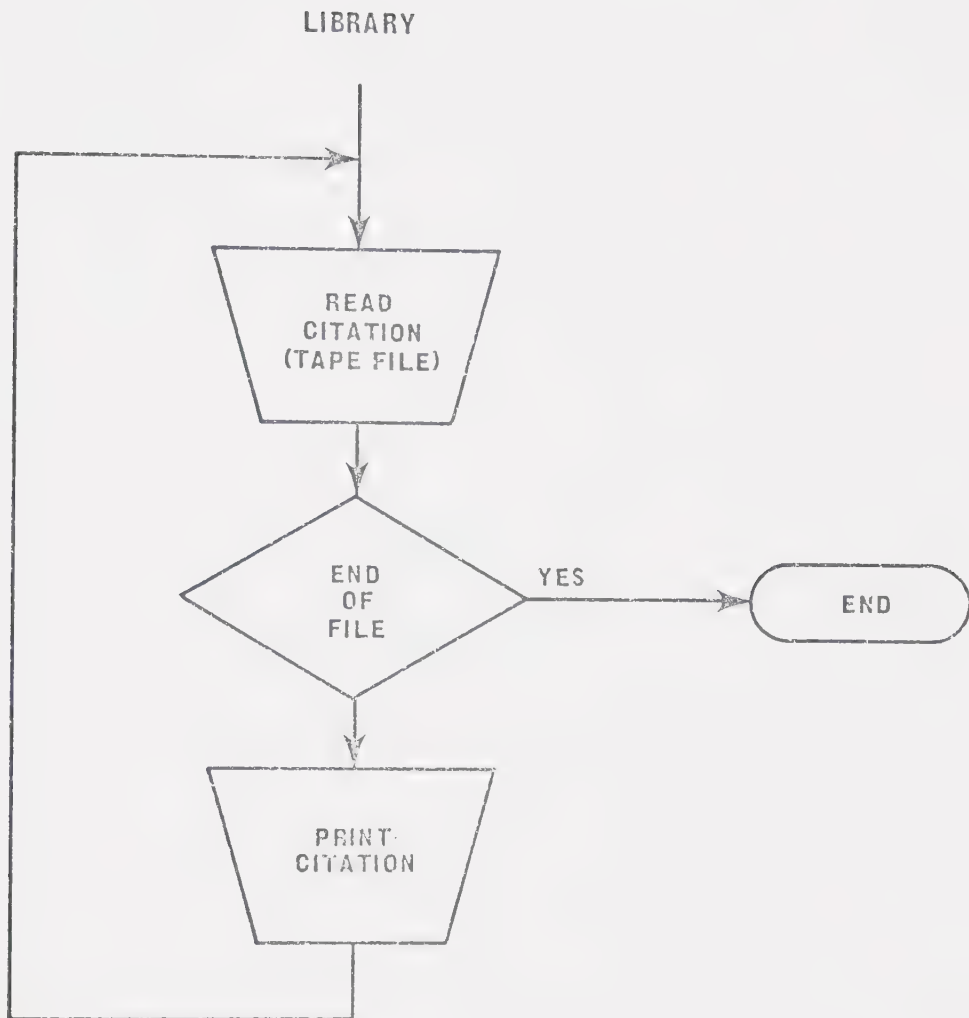


SEARCH (7)



TALLY





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APPENDIX G

The Program Listings

PRE-FILE
AIRHPR PROJECT

H.N.WATTS

THESIS

*** PRE-FILE ***

PROGRAM TO VERIFY THE INGGING CITATIONS PRIOR TO ACTUAL ENTRY
BY THE 'FILE PROGRAM'.
THIS PROGRAM WILL CHECK ALL TERMS AND PRINT THOSE CITATIONS
READY FOR INPUT TO THE FILES.

REAL*8 DICT,TERM(48),BLNK/' '/
INTEGER*2 CODE
INTEGER*4 COMPAP,LENGTH
COMMON DICT(1400),NCODE(48),LENGTH,NDICT,CODE(1400)
LOGICAL*1 CITAT(258)
INTEGER DDCRC(15),AUTH1(20),TTL1(42),TTL2(63),TTL3(63),
1 SOURCE(33),YP(4),LCNUM(11),LIB(2),FORM(4),ERROR(100),DOCNUM

102 FORMAT(5X,I3)
104 FORMAT(2A8,4X,I4)
200 FORMAT(I5,T1,I5A1,2X,A1,62A1/17X,63A1/17X,54A1)
201 FORMAT(15A1,A1,20A1,42A1,63A1,63A1,4A1,11A1,2A1,4A1)
202 FORMAT(I5)
203 FORMAT(16X,8A8)
500 FORMAT('1',10X,'THESAUPUS LIST','0',9X,2A8/(10X,2A8))
600 FORMAT(255A1,3A1)
601 FORMAT(/25X,15A1/20X,A1,2X,20A1,2X,42A1/25X,63A1/25X,
133A1,2X,4A1/25X,11A1,1X,2A1,1X,4A1)
602 FORMAT('1',10X,'SEVERE DESCRIPTOR TERM ERRORS OCCURRED IN:
1 DOCUMENT NUMBERS:',(10X,I9))
603 FORMAT('1',45X,'AIRHPR PRE-FILE CHECK:/')

LENGTH=16

READ IN TERMS AND NUMBERS IN DICTIONARY AND LOOK-UP
READ(5,102) NDICT
NDICT1=2*NDICT

C
C
C
C
C
C
C
C
C
C
C
C

C


```

PRE-FILE
DO 40 INDEX=1,NDICT1,2
  READ(5,104) (DICT(INDEX),DICT(INDEX+1),CODE(INDEX))
40 CONTINUE
  WRITE (6,500) (DICT(INDEX),INDEX=1,NDICT1)
  WRITE(6,603)
C *****
C READ NUMBER OF CITATIONS INPUT
  READ(5,202) NUMCIT
C READ FROM CARDS AND WRITE ON TAPE
  JFK=1
  C=0
DO 50 IJ=1,NUMCIT
  READ(5,200)DOCNUM,CITAT
  WRITE(1,600)CITAT
  K=1
DO 7 III=1,6
  KJ=K+7
  KK=K+4
  READ(5,203) (TERM(J),J=K,KJ)
  IF(ICMPAR(TERM(K+6),BLNK,6)) 5,6,5
5 K=K+8
7 CONTINUE
  NTERM=24
  GO TO 10
6 DO 8 I=K,KK,2
  IF(ICMP4R(TERM(I),BLNK,8)) 8,9,8
8 CONTINUE
  NTERM=K/2+3
  GO TO 10
9 NTERM=I/2
C *****
C READ FROM TAPE AND WRITE (PRINT-OUT).
10 BACKSPACE 1
  READ(1,201) DOCRC,NUMAUT,AUTH1,TTL1,TTL2,TTL3,SOURCE,YR,
  ILCNUM,LIB,FORM
  C=C+NTERM+8
C *****

```



```

      PPE-FILE
      IF(C.LE.60) GO TO 11
      C=NTERM+9
      WRITE(6,503)
11  WRITE(6,601)DDCRC,NUMAUT,AUTH1,TTL1,TTL2,TTL3,SOURCE,YR,LCNUM,
      1LIB,FORM
      CALL LCCKUP(NTERM,TERM,FLAG)
      IF(FLAG.EQ.0) GO TO 50
      ERROR(JFK)=DDCNUM
      JFK=JFK+1
50  CONTINUE
      JKK=JFK-1
      IF(JKK.EQ.0) GO TO 51
      WRITE(6,502) (ERROR(JFK),JFK=1,JKK)
51  REWIND 1
      STOP
      END

```

C
C
C
C
C
C
C
C

SUBROUTINE LOOKUP

THIS SUBROUTINE LOOKS UP THE TERMS INPUT, VERIFIES THEIR EXISTENCE IN THE CURRENT THESAURUS, AND ESTABLISHES THE TERM CODE NUMBER FROM THE INTERNAL THESAURUS. A VECTOR OF TERM CODE NUMBERS IS OUTPUT. IF ALL TERMS ARE FOUND, FLAG IS SET EQUAL TO ZERO.

```

SUBROUTINE LOOKUP(NTERM,TERM,FLAG)
  REAL*8 DICT,TERM(48)
  INTEGER*4 COMPAR
  INTEGER*2 CODE
  COMMON DICT(1400),NCODE(48),LENGTH,NDICT,CODE(1400)
502  FORMAT(I8,2X,2A8)
504  FORMAT('0','10X','TERM NOT FOUND:CHECK ERROR TERM AND THESAURUS,/')
  NTERM1=2*NTERM
  FLAG=0
  DO 50 I=1,NTERM1,2
    J=I/2+1
    INDEX=0
    L=0

```


PRE-FILE

```

NH=NDICT+1
GC TO 63
L=INDEX
61 IF((NH-L).LT.2) GC TO 60
63 INDEX=(NH+L)/2
CALL ICM'PAR(DICT(INDEX*2-1),TERM(I),LENGTH,COMPAR)
64 CONTINUE
IF(COMPAR.LT.0) GO TO 61
IF(COMPAR.GT.0) GC TO 62
NCODE(J)=CCODE(INDEX*2-1)
WRITE(6,502) NCODE(J),(TERM(I),TERM(I+1))
GO TO 50
62 NH=INDEX
GO TO 63
60 WRITE(6,504)
FLAG=FLAG+1
NCODE(J)=0
50 CONTINUE
RETURN
END

```


FILE
AIRHPER PROJECT

THESIS

H.N.WATTS

**** FILE ****

PROGRAM TO FILE DOCUMENT CITATIONS AND CONSTRUCT INVERTED FILE
WITH THE APPROPRIATE DOCUMENT REFERENCE NUMBERS ENTERED WITH
THE TERM CODE NUMBR.
THIS PROGRAM READS:

1. NO. OF THESAURUS TERMS (COL 6-8)
2. THESAURUS TERMS (COL 1-16), CODE NUMBERS (COL 21-24)
3. CURRENT LOCATION NUMBER IE. LPCNUM (COL 1-6)
ADDITION FACTOR IE. ADDFAC (COL 7-10)
CHAIN RECORD NUMBER IE. LCHAIN (COL 11-15)
CURRENT ADDRESS ON CHAIN RECORD IE. LADD (COL 16-20)
4. LOCATION OF EACH TERM CODE IN FILE IE. LDC(K) (1615)
5. NO. OF ELEMENTS IN EACH RECORD IE. NLEM(K) (1615)
6. SPACE REMAINING IN EACH RECORD IE. SPACE(K) (1615)
7. NO. OF DOCUMENTS TO BE READ IE. NUNCI (COL 1-5)
8. DOCUMENT INPUT PROFILES IE. CITAT (25841)
- N.B. DATA SET REFERENCE NUMBERS...CFILE - 1; IFILF - 2

```

REAL*8 DICT,TERM(48),PLNK/,*/
INTEGER*2 CODE,CODEND,TRACK(3646)
INTEGER*4 COMPAR,LENGTH
COMMON DICT(1400),NCODE(48),LENGTH,NDICT,CODE(1400)
LOGICAL*1 CITAT(258)
INTEGER DDCRC(15),AUTH1(20),TTL1(42),TTL2(63),TTL3(63),
1SOURCE(33),YR(4),LONUM(11),LIB(2),FORM(4),CODES(2,350),
2DOCNUM,ADDFAC,LOC(700),NELEM(700),SPACE(700),ADDRES,CHECK,
3REC/-9999/,ERROR(100)
IF TERMS>700 THEN CHANGE DIMENSIONS OF: CODE,LOC,NELEM,SPACE,DICT
102 FORMAT(5X,I3)
103 FORMAT(16,I4,I5,I5)
104 FORMAT(2A8,4X,I4)
105 FORMAT(16I5)

```



```

FILE
2000 FORMAT(I5,T1,15A1,2X,A1,62A1/17X,63A1/17X,63A1/17X,54A1)
2001 FORMAT(15A1,A1,20A1,42A1,63A1,63A1,33A1,4A1,11A1,2A1,4A1)
2002 FORMAT(I5)
2003 FORMAT(16X,8A8)
2004 FORMAT(I5,253X)
2005 FORMAT('1',10X,'TERM NUMBER',I5,' EXISTS IN OVERFLOW OR SPACE
11S PRESENTLY FULL - HENCE JOB IS TERMINATED - CHECK ALL SPACE
2ENTRIES AND PREPARE TO RECREATE THE FILES')
2006 FORMAT('//10X,'ATTEMPTED TO WRITE DOCUMENT NUMBER',I7,
1,' IN A RECORD ALREADY FILLED')
2007 FORMAT('1',10X,'THIS JOB WAS TERMINATED BEFORE ANY EXECUTION -
1NO NEW CARETAKER FILES WERE OUTPUT')
2008 FORMAT('1',10X,'CARETAKER FILES WERE OUTPUT CORRESPONDING TO
1THE CHANGES EXECUTED IN THIS JOB')
2009 FORMAT('1',10X,'TERM NUMBER',I5,' HAS BEEN EMPLOYED TO SYSTEM
1CAPACITY, IT MAY NOT BE USED FURTHER')
2010 FORMAT('1',10X,'TERM NUMBER',I5,' HAS BEEN EMPLOYED BEYOND
1SYSTEM CAPACITY: A TOTAL RECREATE AND EDIT IS NOW MANDATORY.
2NO FILE CHANGES ARE THEREFORE MADE IN THIS JOB, USE THE CURRENT
3FILE IN THE INTERIM.//A8/A8')
2011 FORMAT('//10X,'TERM NUMBER',I5,' EXISTS IN OVERFLOW OR SPACE IS
1CURRENTLY FILLED. CHECK ALL SPACE ENTRIES IN THE CARETAKER FILES
2ON THE NEXT UPDATE')
2000 FORMAT('1',10X,'THESAURUS LIST',//C',9X,2A8/(10X,2A8))
2001 FORMAT('//10X,'TERMS TO BE LOOKED-UP',//O',9X,2A8/(10X,2A8))
2002 FORMAT('//25X,15A1//)
2003 FORMAT(23X,20A1,2X,42A1/25X,63A1/23X,33A1,2X,4A1/25X,
11A1,1X,2A1,1X,4A1)
2004 FORMAT('//10X,'CODES(1,1)')/(18))
2005 FORMAT('//10X,'CODES(2,1)')/(18))
2006 FORMAT('1',10X,'SEVERE DESCRIPTOR TERM ERROR(S) OCCURRED IN THE
1FOLLOWING DOCUMENTS, AND THEY WERE NOT FILED.//(10X,18))
2007 FORMAT('//10X,'DOCUMENT NO.',I8,' WAS NOT FILED DUE TO ERRORS.///
1//)
2008 FORMAT('1',50X,'A18P8P FILE')

```


FILE

```

C      LENGTH=16
C      READ NUMBER OF TERMS; TERMS; TERM CODE NUMBERS IN THESAURUS
C      READ(5,102) NDICT
C      NDICT1=2*NDICT
C      DO 40 INDEX=1,NDICT1,2
C      READ(5,104) (DICT(INDEX),DICT(INDEX+1),CODE(INDEX))
C      40 CONTINUE
C      DEFINE CITATION FILE
C      IF CITATION FILE>400 THEN CHANGE 'DEFINE FILE'
C      DEFINE FILE 1(400,258,L,I1)
C      WRITE "SAFETY-NUMBER" IN EACH RECORD TO AVOID OVER-WRITE
C      REMOVE WITH COPYIF, COPYCF
C      IF CITATION FILE>400 THEN CHANGE MAX OF 'KLL'
C      DO 20 KLL=1,400
C      WRITE(1,KLL)REC
C      20 CONTINUE
C      DEFINE INVERTED FILE
C      IF INVERTED FILE REQUIRES>20 TRACKS, THEN CHANGE 'DEFINE FILE'
C      DEFINE FILE 2(20,1823,U,I2)
C      WRITE SKELETON RECORDS IN EARLY TESTS PRIOR TO USE OF COPY
C      REMOVE WITH COPYIF, AND COPYCF
C      IF INVERTED FILE REQUIRES>20 TRACKS THEN CHANGE MAX OF 'KL'
C      DO 30 KL=1,20
C      WRITE(2,KL)TRACK
C      30 CONTINUE
C      WRITE (6,500) (DICT(INDEX),INDEX=1,NDICT1)
C      WRITE(6,607)
C      *****
C      READ IN CURRENT LOCATION NUMBER, AND ADDITION FACTOR
C      READ(5,103)LOCNUM,ADDFAC,LCHAIN,LADD
C      LAST= NDICT
C      *****
C      READ IN CAPETAKER FILES: LOC(K),NFLEM(K),SPACE(K)
C      READ IN LOCATION VECTOR
C      READ(5,105) (LOC(K),K=1,LAST)
C      READ IN NUMBER OF ELEMENTS VECTOR

```



```

      FILE
      READ(5,105) (NELEM(K),K=1, LAST)
      READ IN SPACE VECTOR - SPACE FOR ADDITION TO EACH RECORD
      READ(5,105) (SPACE(K),K=1, LAST)
      DO 25 K=1, LAST
      IF(SPACE(K)) 24,26,25
      26 IF(LOC(K).EQ.0) GO TO 25
      24 WRITE(6,205)K
      GO TO 97
      25 CONTINUE
C *****
C READ NUMBER OF CITATIONS INPUT
      READ(5,202) NUMCIT
C *****
C READ FROM CARDS AND WRITE ON TAPE
      CODEND=0
      JFK=1
      C=1
      DO 50 IJ=1, NUMCIT
      READ CITATIONS FROM CARDS
      READ(5,200) OCCNUM, CITAT
      FIND(1, OCCNUM)
      K=1
C *****
C READ TERMS IN THE INPUT PROFILE: CHECK FOR BLNK; FIND NTERM
      DO 7 III=1,6
      KJ=K+7
      KK=K+4
      READ(5,203) (TERM(J),J=K,KJ)
      IF(BLNK.EQ.TERM(K+6)) GO TO 6
      5 K=K+8
      7 CONTINUE
      NTERM=24
      GO TO 10
      6 DO 8 I=K, KK,2
      IF(BLNK.EQ.TERM(I)) GO TO 9
      8 CONTINUE

```


FILE

```

NTERM=K/2+3
GO TO 10
9 NTERM=I/2
C *****
C CALL SUBROUTINE LOOKUP TO VERIFY THE TERMS
10 C=C+NTERM+8
IF(C.LE.60) GO TO 11
C=NTERM+9
WRITE(6,607)
11 CALL LOOKUP(NTERM,TERM,FLAG)
IF(FLAG.NE.0) GO TO 47
C *****
C CHECK CITATION RECORD PRIOR TO WRITING
READ(1,DCCNUM)CHECK
IF(CHECK.NE.-9999) GO TO 49
WRITE(1,DCCNUM)CITAT
WRITE(6,601) (CITAT(L),L=1,15)
WRITE(6,602) (CITAT(M),M=17,258)
C *****
C ADD AND STORE IN THE VECTORS OF TERM NUMBERS AND DOCUMENT NOS.
I=0
DO 75 I=1,NTERM
CODES(1,CODEND+I)=NCODE(I)
CODES(2,CODEND+I)=DCCNUM
75 CONTINUE
CODEND=CODEND+NTERM
GO TO 50
49 WRITE(6,206)DCCNUM
47 WRITE(6,606)DCCNUM
48 ERROR(JFK)=DCCNUM
JFK=JFK+1
50 CONTINUE
JFK=JFK-1
WRITE(6,605) (ERROR(JFK),JFK=1,JKK)
IF(CODEND.EQ.0) GO TO 70
C SORT THE VECTORS OF TERM NUMBERS AND DOCUMENT NUMBERS

```



```

      FILE
DO 84 IM=ADDRESS,NEXT
  TRACK(IM)=CODES(2,JJ)
  JJ=JJ+1
84 CONTINUE
  LEFT=3646-LADD+1
  IF(LEFT.LT.MDIFF+2) GO TO 98
  GO TO 99
98 LCHAIN=LCHAIN+1
  LADD=1
99 NEXT1=NEXT+1
  NEXT2=NEXT+2
  TRACK(NEXT1)=LCHAIN
  TRACK(NEXT2)=LADD
  WRITE(2,NUMREC) (TRACK(1A),IN=1,3646)
  READ(2,LCHAIN) (TRACK(IN),IN=1,3646)
  ADDRES=LADD
  NEXT=ADDRESS+MDIFF+1
DO 85 IM=ADDRESS,NEXT
  TRACK(IM)=CODES(2,JJ)
  JJ=JJ+1
85 CONTINUE
  WRITE(2,LCHAIN) (TRACK(IN),IN=1,3646)
  LADD=LADD+MDIFF+2
  IF(LADD.LT.3646) GO TO 73
  LADD=1
  LCHAIN=LCHAIN+1
73 NELEM(K)=NELEM(K)+NCOUNT
  GO TO 60
C *****
C  ENOUGH SPACE IS AVAILABLE IN RECORD
71 SPACE(K)=SPACE(K)-NCOUNT
  READ(2,NUMREC) (TRACK(IN),IN=1,3646)
  ADDRES=(LOC(K)-(NUMREC-1)*3646)+NELEM(K)
  NEXT=NCOUNT+ADDRES-1
  JJ=JJ+1
DO 81 IM=ADDRESS,NEXT

```



```

      FILE
      TRACK(IM)=CODES(2,JJ)
      JJ=JJ+1
81  CONTINUE
      WRITE(2,NUMREC) (TRACK(IN),IN=1,3646)
      NELEM(K)=NELEM(K)+NCOUNT
      GO TO 60
*****
C  OUTPUT CARETAKER FILES
C  70 WRITE(6,208)
C  CHECK THE RESULTING CARETAKER FILES
C  DO 95 K=1, LAST
C  IF (SPACE(K)) 94,96,95
C  96 IF (LDC(K).EQ.0) GO TO 95
C  94 WRITE(6,211)K
C  95 CONTINUE
C  PUNCH 103, LCCNUM, ADDFAC, LCHAIN, LADD
C  PUNCH 105, (LDC(K), K=1, LAST)
C  PUNCH 105, (NELEM(K), K=1, LAST)
C  PUNCH 105, (SPACE(K), K=1, LAST)
C  GO TO 100
*****
C  THIS SECTION OF THE PROGRAM WILL CAUSE AN INTERRUPT OF THE JOB
C  THE BUFFER WILL BE CLEARED, AND NO COPY OUT STEPS WILL EXECUTE.
C  101 WRITE(6,210)K,BLNK,BLNK
C  TERM(9000000000)=BLNK
C  97 WRITE(6,207)
C  100 STOP
C  END
C  SUPROUTINE LOOKUP
C
C  THIS SUPROUTINE LOOKS UP THE TERMS INPUT, VERIFIES THEIR
C  EXISTENCE IN THE CURRENT THESAURUS, AND ESTABLISHES THE TERM CODE
C  NUMBER FROM THE INTERNAL THESAURUS. A VECTOR OF TERM CODE NUMBERS
C  IS OUTPUT. IF ALL TERMS ARE FOUND, FLAG IS SET TO ZERO.
C
C  SUBROUTINE LOOKUP(NTERM,TERM,FLAG)

```



```

FILE
REAL*8 DICT,TERM(48)
INTEGER*4 COMPAR
INTEGER*2 CODE
COMMON DICT(1400),NCODE(48),LENGTH,NDICT,CODE(1400)
502 FORMAT(18,2X,2A8)
504 FORMAT('0',10X,'TERM NOT FOUND:CHECK ERROR TERM AND THESAURUS'//)
NTERM1=2*NTERM
FLAG=0
DO 50 I=1,NTERM1,2
  J=I/2+1
  INDEX=0
  L=0
  NH=NDICT+1
  GO TO 63
61 L=INDEX
63 IF((NH-L).LT.2) GO TO 60
  INDEX=(NH+L)/2
  CALL ICMPar(DICT(INDEX*2-1),TERM(I),LENGTH,COMPAR)
64 CONTINUE
  IF(COMPAR.LT.0) GO TO 61
  IF(COMPAR.GT.0) GO TO 62
  NCODE(J)=CODE(INDEX*2-1)
  WRITE(6,502) NCODE(J),(TERM(I),TERM(I+1))
  GO TO 50
62 NH=INDEX
  GO TO 63
60 WRITE(6,504)
  FLAG=FLAG+1
  NCODE(J)=0
50 CONTINUE
  RETURN
  END

```



```

SEARCH
201 FORMAT(10X,21A1/10X,30A1/10X,25A1//)
202 FORMAT(5X,*****',21A1,*****')
203 FORMAT(/10X,A2,A4)
204 FORMAT(10X,A2,19A4,A2)
205 FORMAT('1',10X,'END OF THE PROFILES WAS FOUND')
206 FORMAT(/10X,'A SERIOUS ERROR OCCURRED IN THIS PROFILE')
207 FORMAT(/10X,'MIXED-MODE IS NOT PERMITTED: AUTHOR AND DESCRIPTORS
1 MUST BE IN SEPARATE PARAMETERS')
208 FORMAT(/10X,'NO SEARCH COMMAND RECEIVED, NO SEARCH PERFORMED')
209 FORMAT(/10X,'SORTED DOCUMENTS FOR PARM NO.',I4/(I8))
210 FORMAT(/10X,'USING AUTHOR PARAMETERS - "AND" PARAMETERS MUST
1 PRECEDE "NOT" PARAMETERS / ONLY ONE "AND" OR ONE "NOT" PARAMETER
2 SHOULD BE USED')
211 FORMAT(/10X,'ATTEMPTED TO SEARCH FOR AUTHOR IN BLANK FIELD')
212 FORMAT('1',10X,'QUESTION NO.',I4,5X,18A4,A2//)
302 FORMAT(5X,I3)
304 FORMAT(2A8,4X,I4)
400 FORMAT(/10X,'NO DOCUMENT HITS WERE FOUND FOR THIS QUESTION')
500 FORMAT('1',10X,'THESAURUS LIST','0',9X,2A8/(10X,2A8))
601 FORMAT(/25X,15A1//)
602 FORMAT(23X,20A1,2X,42A1/25X,63A1/23X,32A1,2X,4A1/25X,
111A1,1X,2A1,1X,4A1)
C *****
C READ IN NUMBER OF TERMS AND SYSTEM THESAURUS
  LENGTH=16
  READ(5,302)NDICT
  NDICT1=2*NDICT
  DO 40 INDEX=1,NDICT1,2
    READ(5,304) (DICT(INDEX),DICT(INDEX+1),CODE(INDEX))
  40 CONTINUE
C   DEFINE CITATION FILE
C   DEFINE FILE 1(400,258,L,I1)
C   DEFINE INVERTED FILE
C   DEFINE FILE 2(20,1823,U,I2)
  WRITE(6,500) (DICT(INDEX),INDEX=1,NDICT1)
  LAST=NDICT

```



```

C ***** SEARCH *****
C READ IN CARETAKER FILES, EXCLUDING UPDATE RECORD CARD
C READ IN LOCATION VECTOR
C READ(5,105) (LCC(K),K=1,LAST)
C READ IN NUMBER OF ELEMENTS VECTOR
C READ(5,105) (NELEM(K),K=1,LAST)
C READ IN SPACE VECTOR
C READ(5,105) (SPACE(K),K=1,LAST)
C *****
C READ DATE OF SEARCH
C READ(5,100)DATE
C NUMQ=0
C *****
C SEARCH PROCEDURE BEGINS FOR A SINGLE QUESTION
10 CONTINUE
C NUMQ=NUMQ+1
C PARNUM=0
C FFLAG=0
C DO 13 I=1,10
C NOTPAR(I)=0
13 CONTINUE
C READ(5,104,END=98)CHECK1,TERM
15 C=0
C IF(CHECK1.EQ.T) GO TO 11
C IF(CHECK1.EQ.AG) GO TO 12
11 C=C+7
C WRITE(6,200)NUMQ,DATE,(TERM(I),I=2,20)
C READ(5,102,END=98)CHECK2,NAME,ADD1,ADD2
C IF(CHECK2.NE.F) FFLAG=FFLAG+1
C WRITE(6,201)NAME,ADD1,ADD2
C C=C+5
C GO TO 20
12 C=C+10
C WRITE(6,200)NUMQ,DATE,(TERM(I),I=2,20)
C WRITE(6,202)NAME
20 CONTINUE

```


SEARCH

```

DO 16 I=2,20
HEAD(I)=TERM(I)
16 CONTINUE
NAUT(1)=0
NAUT(2)=0
READ(5,104,END=98) IDENT, TERM
21 IF(PARM.EQ.AND) GO TO 26
IF(PARM.EQ.NOT) GO TO 25
IF(PARM.EQ.SEAR) GO TO 70
IF(PARM.EQ.T) GO TO 69
IF(PARM.EQ.AG) GO TO 69
WRITE(6,204) IDENT, TERM
C=C+1
GO TO 90
25 NCTPAR(PARNUM+1)=1
26 WRITE(6,203) IDENT, TERM(1)
C=C+2
PARNUM=PARNUM+1
TERNUM=1
30 READ(5,104,END=98) IDENT, TERM
IF(IDENT.NE.D) GO TO 31
NTERM=1
WRITE(6,204) IDENT, TERM
C=C+1
CALL LOOKUP(NTERM, TERM, FLAG)
IF(NCODE(1).EQ.0) GO TO 90
KODE(PARNUM, TERNUM)=NCODE(1)
TERNUM=TERNUM+1
GO TO 30
31 CONTINUE
STOPER(PARNUM)=TERNUM-1
IF(IDENT.EQ.A) GO TO 60
IF(IDENT.EQ.AN) GO TO 26
IF(IDENT.EQ.NC) GO TO 25
IF(IDENT.EQ.SE) GO TO 70
IF(IDENT.EQ.T) GO TO 69

```



```

SEARCH
IF(IDENT.EQ.AG) GO TO 69
WRITE(6,204)IDENT,TERM
C=C+1
GO TO 90
C *****
60 CONTINUE
C THIS ROUTINE HANDLES AUTHOR PARAMETERS OR PRINTS MIXED-MODE ERROR
WRITE(6,204)IDENT,TERM
C=C+1
IF(ITERNUM.GT.1) GO TO 61
PARNUM=PARNUM-1
IF(NOTPAR(PARNUM+1)) 700,700,701
700 TYPE=1
GO TO 699
701 TYPE=2
699 ANUM=1
702 CALL MOVE(MAT(1,TYPE,ANUM),TERM(1),20)
READ(5,104,END=98)IDENT,TERM
IF(IDENT.EQ.A) GO TO 703
IF(IDENT.EQ.SE) GO TO 705
WRITE(6,203)IDENT,TERM(1)
C=C+2
IF(IDENT.EQ.NC) GO TO 704
IF(IDENT.EQ.D) GO TO 61
IF(IDENT.EQ.AN) GO TO 62
IF(IDENT.EQ.T) GO TO 69
IF(IDENT.EQ.AG) GO TO 69
WRITE(6,204)IDENT,TERM
C=C+1
GO TO 90
703 ANUM=ANUM+1
WRITE(6,204)IDENT,TERM
C=C+1
GO TO 702
704 NAUT(TYPE)=ANUM
IF(TYPE.EQ.2) GO TO 62

```


SEARCH

```

TYPE=2
ANUM=1
GO TO 702
705 NAUT(TYPE)=ANUM
GO TO 70
61 WRITE(6,207)
GO TO 90
62 WRITE(6,210)
GO TO 90
69 CONTINUE
WRITE(6,208)
NUMQ=NUMQ+1
PARNUM=0
FFLAG=0
DO 14 I=1,10
  NOTPAR(I)=0
14 CONTINUE
GO TO 15
C *****
70 CONTINUE
C THE SEARCH OF THE FILES BEGINS FOR THE QUESTION
DO 71 L=1,PARNUM
  J=1
  NSTOP=STOPER(L)
  DO 72 LOOK=1,NSTOP
    K=KODE(L,LOOK)
    FFLAG=0
    NUMREC=LOC(K)/3646+1
    FIND(2,NUMREC)
    NOELFM=NELEM(K)
    IF(NOELFM.EQ.0) GO TO 72
    IS THERE OVERFLOW IN THE RECORD BEING READ?
    IF(SPACE(K).LT.0) FFLAG=FFLAG+1
C *****
C BEGIN READING RECORDS IN THE INVERTED FILE
77 CONTINUE

```



```

SEARCH
READ(2,NUMREC) (TRACK(IN),IN=1,3646)
ADDRES=LOC(K)-(NUMREC-1)*3646
NEXT=ADDRES+NOELEM-1
IF(FFLAG.EQ.0) GO TO 81
OVERFLOW USED IN WRITING THIS RECORD
NEXT=NEXT+SPACE(K)
DO 79 IT=ADDRES,NEXT
VECTOR(J)=TRACK(IT)
J=J+1
79 CONTINUE
LCHAIN=TRACK(IT)
LADD=TRACK(IT+1)
FIND(2,LCHAIN)
MDIFF=-((SPACE(K))
ADDRES=LADD
READ(2,LCHAIN) (TRACK(IN),IN=1,3646)
NEXT=ADDRES+MDIFF-1
DO 80 IT=ADDRES,NEXT
VECTOR(J)=TRACK(IT)
J=J+1
80 CONTINUE
GO TO 72
C *****
81 CONTINUE
NO CONTINUATION, NO OVERFLOW
DO 82 IT=ADDRES,NEXT
VECTOR(J)=TRACK(IT)
J=J+1
82 CONTINUE
72 CONTINUE
NUMENT=J-1
IF(NUMENT.NE.0) GO TO 73
IF(NOTPAR(L).EQ.1) GO TO 71
GO TO 75
C *****
C SORT VECTOR(J)
C *****

```



```

SEARCH
73 CALL BISORT(VECTOR,4,NUMENT,1,4)
   IF(L.NE.1) GO TO 2
   TV=1
   DO 1 IV=1,NUMENT
     IF(TV.EQ.1) GO TO 3
     IF(TEMP(TV-1).EQ.VECTOR(IV)) GO TO 1
3    TEMP(TV)=VECTOR(IV)
     TV=TV+1
1    CONTINUE
     LOTS=TV-1
     GO TO 71
2    IF(NOTPAR(L).EQ.1) GO TO 93
     TV=1
     FV=1
     DO 7 IV=1,NUMENT
       IF(TV.GT.LOTS) GO TO 9
       IF(TEMP(TV)-VECTOR(IV)) 5,6,7
5      TV=TV+1
       GO TO 8
6      IF(TEMP(FV-1).EQ.TEMP(TV)) GO TO 63
       TEMP(FV)=TEMP(TV)
       FV=FV+1
63     TV=TV+1
7     CONTINUE
9     LOTS=FV-1
     GO TO 71
93    TV=1
     FV=1
     DO 94 IV=1,NUMENT
       IF(TV.GT.LOTS) GO TO 4
       IF(TEMP(TV)-VECTOR(IV)) 95,96,94
95     IF(TEMP(FV-1).EQ.TEMP(TV)) GO TO 64
       TEMP(FV)=TEMP(TV)
       FV=FV+1
64     TV=TV+1
     GO TO 97

```


SEARCH

```

96 TV=TV+1
94 CONTINUE
  4 LOTS=FV-1
71 CONTINUE
  IF(LOTS.EQ.0) GO TO 75
  IF((NAUT(1)+NAUT(2)).EQ.0) GO TO 899
  *****
  THIS ROUTINE CALCULATES THE LENGTH OF THE COMPAR FIELD FOR EACH
  AUTHOR TERM IN THE SEARCH
  DO 800 TYPE=1,2
    MMM=NAUT(TYPE)
    IF(MMM.EQ.0) GO TO 800
    DO 801 J=1,MMM
      I=20
802 DUM1=MAT(I,TYPE,J)
      IF(DUM.NE.BLANK) GO TO 803
      I=I-1
      IF(I.EQ.0) GO TO 805
      GO TO 802
805 WRITE(6,211)
      C=C+2
      GO TO 801
803 LAUT(TYPE,J)=I
801 CONTINUE
  *****
800 CONTINUE
  FFLAG=0
  THIS ROUTINE PERFORMS THE COMPAR OF AUTHOR IN THE CIT FILE.
  DO 901 II=1,LOTS
    READ(1,TEMP(II))CITAT
    DUM1=CITAT(16)
    NUMAUT=1
    IF(DUM.EQ.ONE) GO TO 898
    NUMAUT=2
    IF(DUM.EQ.TWO) GO TO 898
    NUMAUT=3

```



```

SEARCH
898 IF(NAUT(1).EQ.0) GO TO 908
    DO 903 N=1,NUMAUT
        NNN=NAUT(1)
        DO 904 ANUM=1,NNN
            IF(ICMPAR(CITAT(CMPFLD(N)),MAT(1,1,ANUM),LAUT(1,ANUM)))904,908,904
904 CONTINUE
903 CONTINUE
    GO TO 901
908 IF(NAUT(2).EQ.0) GO TO 909
    DO 905 N=1,NUMAUT
        NNN=NAUT(2)
        DO 906 ANUM=1,NNN
            IF(ICMPAR(CITAT(CMPFLD(N)),MAT(1,2,ANUM),LAUT(2,ANUM)))906,902,906
906 CONTINUE
905 CONTINUE
909 C=C+9
    IF(C.LE.60) GO TO 910
    C=15
    WRITE(6,212)NUMQ,(HEAD(I),I=2,20)
    WRITE(6,601) (CITAT(L),L=1,15)
    FFLAG=FFLAGG+1
    WRITE(6,602) (CITAT(M),M=17,258)
    PUNCH 111,(CITAT(I),I=1,5),NAME,ADD1,(ADD2(N),N=1,14)
901 CONTINUE
    IF(FFLAGG.EQ.0) GO TO 75
    GO TO 10
899 DO 900 II=1,LCTS
    READ(1,TEMP(II))CITAT
    C=C+9
    IF(C.LE.60) GO TO 897
    C=15
    WRITE(6,212)NUMQ,(HEAD(I),I=2,20)
    WRITE(6,601) (CITAT(L),L=1,15)
    WRITE(6,602) (CITAT(M),M=17,258)
    PUNCH 111,(CITAT(I),I=1,5),NAME,ADD1,(ADD2(N),N=1,14)
900 CONTINUE

```


SEARCH

GO TO 10
75 WRITE(6,400)

GO TO 10

C *****

90 CONTINUE

C THIS ROUTINE WILL WRITE OUT PROFILE IF SERIOUS ERROR IS COMMITTED
C TERMS USED WILL ALSO BE LOCKED UP

READ(5,104,END=98)IDENT,TERM

IF(IDENT.EQ.98) GO TO 92

IF(IDENT.NE.0) GO TO 91

NTERM=1

WRITE(6,204)IDENT,TERM

CALL LOOKUP(NTERM,TERM,FLAG)

GO TO 90

91 WRITE(6,204)IDENT,TERM

GO TO 90

92 WRITE(6,206)

GO TO 10

98 WRITE(6,205)

99 STOP

END

SUBROUTINE LOOKUP

C

C

C

C

C

C

C

THIS SUBROUTINE LOOKS UP THE TERMS INPUT, VERIFIES THEIR
EXISTENCE IN THE CURRENT THESAURUS, AND ESTABLISHES THE TERM CODE
NUMBER FROM THE INTERNAL THESAURUS. A VECTOR OF TERM CODE NUMBERS
IS OUTPUT. IF ALL TERMS ARE FOUND, FLAG IS SET TO ZERO.

SUBROUTINE LOOKUP(NTERM,TERM,FLAG)

REAL*8 DICT,TERM(2)

INTEGER*4 COMPAR

INTEGER*2 CODE

COMMON DICT(1400),NCODE (2),LENGTH,NDICT,CODE(1400)

502 FORMAT(/10X,2A8)

504 FORMAT('0',10X,'TERM NOT FOUND:CHECK ERROR TERM AND THESAURUS')

NTERM1=2*NTERM

SEARCH

```

FLAG=0
DO 50 I=1, NTERM1, 2
  J=I/2+1
  INDEX=0
  L=0
  NH=NDICT+1
63 IF((NH-L).LT.2) GO TO 60
  INDEX=(NH+L)/2
  CALL ICOMP( DICT( INDEX*2-1), TERM(I), LENGTH, COMPAR )
64 CONTINUE
  IF( COMPAR.LT.0) GO TO 61
  IF( COMPAR.GT.0) GO TO 62
  NCODE(J)=CNCODE( INDEX*2-1)
  GO TO 50
61 L=INDEX
  GO TO 63
62 NH=INDEX
  GO TO 63
60 WRITE(6,504)
  FLAG=FLAG+1
  NCODE(J)=0
50 CONTINUE
  RETURN
  END

```



```

C
C      TALLY      AIRHPR PROJECT      H.N.WATTS
C
C      *** TALLY ***
C
C      THIS PROGRAM READS THE CURRENT CUMULATED TOTALS FOR EACH
C      DOCUMENT IN THE SYSTEM.  THE TALLY CARDS ARE THEN READ AND THE
C      ADDITIONS ARE MADE TO THE CUMULATED TOTALS
C      INTEGER DATE(2),LABEL(17),DOCTOT(300),DOCNUM
C      CHANGE THE DIMENSION OF DOCTOT CORRESPONDING TO THE NUMBER OF
C      DOCUMENTS IN THE SYSTEM
C      100 FORMAT(2A4,4X,17A4)
C      101 FORMAT(16I5)
C      102 FORMAT(I5)
C      200 FORMAT('1',50X,'AIRHPR TALLY RECORD',//10X,17A4,22X,'DATE ',
C      12A4//15X,'THIS RECORD CONTAINS THE CURRENT TOTALS FOR ALL DOCUMENT
C      2S IN THE SYSTEM',//)
C      201 FORMAT(/5(10X,'(',15,' '),2X,15))
C      READ(5,102)NSIZE
C      READ(5,100)DATE,LABEL
C      READ(5,101) (DOCTOT(DOCNUM),DOCNUM=1,NSIZE)
C      10 READ(5,102,END=99)NUMBER
C      DOCNUM=NUMBER
C      DOCTOT(DOCNUM)=DOCTOT(DOCNUM)+1
C      GO TO 10
C      99 WRITE(6,200)LABEL,DATE
C      WRITE(6,201) (DOCNUM,DOCTOT(DOCNUM),DOCNUM=1,NSIZE)
C      PUNCH 101, (DOCTOT(DOCNUM),DOCNUM=1,NSIZE)
C      STOP
C      END

```



```
C
C
C
C
C
C
      LIBRARY
      AIRPER PROJECT
      H.N.WATTS

      THESIS

      *** LIBRARY ***

      THIS PROGRAM PRINTS THE CONTENTS OF THE CITATION FILE

      LOGICAL*1 CITAT(258)
100  FORMAT(250A1,8A1)
200  FORMAT('1',45X,'ALPERTA INFORMATION RETRIEVAL FOR HEALTH',45X,
1      '-----',49X,
2      'PHYSICAL EDUCATION AND RECREATION',48X,
3      '-----',48X,
205  FORMAT('1',10X,'END OF FILE WAS FOUND')
601  FORMAT('//25X,15A1//23X,20A1,2X,42A1/25X,63A1/23X,33A1,
12X,4A1/25X,11A1,1X,2A1,1X,4A1)
      C=4
      WRITE(6,200)
      DO 50 I=1,99999
      READ(1,100,END=99)CITAT
      C=C+9
      IF(C.LE.60) GO TO 55
      C=13
      WRITE(6,200)
55  WRITE(6,601) (CITAT(L),L=1,15),(CITAT(M),M=17,258)
50  CONTINUE
99  WRITE(6,205)
      STOP
      END
```



```

BISORT      CSECT
            USING *,15
* THIS ROUTINE WILL SORT A GROUP OF RECORDS IN CORE USING A BINARY
* SORT OVER ANY FIELD WITHIN THE RECORD.  THE MAXIMUM RECORD
* LENGTH IS 256 BUT ALL RECORDS MUST BE THE SAME LENGTH.
* CALLING SEQUENCE IS BISORT(ARRAY,RECL,NUMBER,START,LENGTH)
* ARRAY IS ADDR OF FIRST RECORD.
* RECL IS LENGTH OF EACH RECORD
* NUMBER IS NUMBER OF RECORDS TO BE SORTED.
* START IS THE NUMBER OF CHARACTERS FROM THE FIRST IN THE RECORD
* TO THE BEGINNING OF THE COMPARE FIELD.
* LENGTH IS THE LENGTH OF THE COMPARE FIELD.
            SAVE (14,12),,BISORT
LM          2,6,0(1) ADDR'S OF ARGUMENTS
L           3,0(3) RECORD LENGTH
LR          7,3
BCTR        7,0 RECORD LENGTH MINUS 1
STC         7,MOVE1+1
STC         7,MOVE2+1
STC         7,MOVE3+1
L           12,0(5) POSITION OF COMPARE FIELD
BCTR        12,0
STC         12,CCMPARE+3
STC         12,CCMPARE+5
L           10,0(6) LENGTH OF COMPARE FIELD
BCTR        10,0
STC         10,CCMPARE+1
LH          5,0(4) NUMBER OF RECORDS TO BE SORTED
BCTR        5,0
MR          4,3      (RECORD COUNT - 1)*LENGTH
AR          5,2      ADDR OF LAST RECORD
LR          4,2      FETCH FIRST RECORD
SR          11,11     FLAG=OFF
LR          6,4
B           **+6
NEXT        AR          4,3      RECCRD(I)
BEGIN      LR          4,2      FETCH FIRST RECORD
            SR          11,11     FLAG=OFF
            LR          6,4
            B           **+6

```



```

CR      BISORT
BL      4,5  LAST RECORD?
COMP    NC
LTR     11,11 YES, IS FLAG OFF
BZ      RETURN IF SC, GO BACK TO CALLER
SR      5,3  DECREASE LIST BE ONE RECORD
B       BEGIN
AR      6,3  RECORD(I+1)
CLC     0(0,4),0(6)  COMPARE THE TWO COMPARE FIELDS
BNH     NEXT
MVC     SAVE(0),0(4)  SAVE RECORD(I)
MVC     0(0,4),0(6)  RECORD(I)=RECORD(I+1)
MVC     0(0,6),SAVE  RECORD(I+1)=RECORD(I)
LA      11,1  SET FLAG=ON
B       NEXT
R       RETURN (14,12)
DS      CL255
END

```

COMP
 COMPARE
 MOVE1
 MOVE2
 MOVE3
 RETURN
 SAVE


```

ICMPAR      CSECT
* THIS ROUTINE DOES A LOGICAL COMPARE OF TWO CHARACTER STRINGS.
* THE FORTRAN SUBROUTINE CALLING SEQUENCE IS
*
* CALL ICMPAR(STRING1,STRING2,LENGTH,I)
* IF I=-1, THEN STRING1<STRING2
* IF I=0, THEN STRING1=STRING2
* IF I=1, THEN STRING1>STRING2
* THIS ROUTINE CALL ALSO BE USED AS A FUNCTION IN WHICH CASE THE
* LAST ARGUMENT MUST BE OMITTED
      USING *,J5
      R 12(15)
      DC X'7'
      DC CL7*ICMPAR*
      SAVE (14,7)
      LM 2,5,0(1) ADDR'S OF ARGUMENTS
      L 7,0(4) FETCH LENGTH
      BCTR 7,0 DECREASE LENGTH BY 1
      SR 6,6 I=0
      EX 7,COMPARE
      BH HIGH IS STRING1 HIGH?
      BL LOW IS STRING1 LOW?
      LTR 4,4 ARE THERE ONLY 3 ARGUMENTS?
      BNM SUBROUT SUBROUTINE OR FUNCTION?
      ST 6,20(13) RETURN FUNCTION VALUE
      RETURN (14,7)
      SUBROUT ST 6,0(5) RETURN SUBROUTINE VALUE
      B RETURN
      LA 6,1 I=1
      B STRESULT
      BCTR 6,0
      B STRESULT
      CLC 0(0,2),0(3)
      END

```



```

IMOVE      CSECT
* THIS ROUTINE WILL MOVE 'LENGTH' CHARACTERS FROM NAME2 TO NAME1.
* IF 'LENGTH' IS LESS THAN 1, NO CHARACTERS WILL BE MOVED THE CALL IS
* CALL IMOVE(NAME1,NAME2,LENGTH)
* NAME1 OR NAME2 CAN BE ANY VARIABLE OR CONSTANT EXCEPT AN HEXEDECIMAL
* CONSTANT. LENGTH CAN BE ANY LENGTH GREATER THAN ZERO.
      USING #,15
      B      10(15)
      DC     X'5'
      DC     CLE,IMOVE'
      SAVE   (14,8)
      LM     2,4,0(1)
      L      R,=F'256'
      L      5,0(4) FETCH ORIGINAL LENGTH
      LA     6,1 CNE
      CR     5,6 IS LENGTH LESS THAN 1
      RL     RETURN
      CR     5,8
      BH     REDUCE LENGTH
      LR     7,5
      SR     5,5 NEXT LENGTH=0
      ACTR   7,C
      EX     7,MOVE UP TO 256 CHARACTERS
      AR     2,8
      AR     3,8
      B      NEXT MOVE
      LR     7,8
      SR     5,8
      B      DCMOVE
      RETURN (14,8)
      MVC    0(0,2),0(3)
      END
NEXT
DGMOVE
REDUCE
RETURN
MOVE

```


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